■ Precision Cooling For Business-Critical Continuity<sup>™</sup>

# Liebert® DM 16kW Air Conditioner

User Manual







# Liebert\_DM 16kW Air Conditioner User Manual

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# **Chapter 1 Overview**

This chapter introduces the features, main parts, requirements on transportation and storage environment of the Liebert\_DM 16kW (DME16) air conditioner.

# 1.1 Model Description

The model description of Liebert\_DM 16kW air conditioner is shown in Figure 1-1.

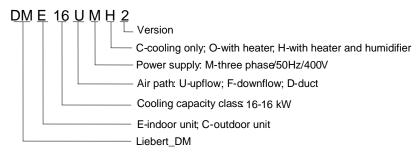


Figure 1-1 Model description

#### 1.2 Product Introduction

Liebert\_DM 16kW air conditioner is a medium-large sized precision environment control system, suitable to the environment control of the equipment room or computer room. It aims to provide a sound operation environment for precision equipment, such as sensitive equipment, industry processing equipment, communication equipment and computers.

Liebert\_DM 16kW air conditioner features high reliability, high sensible heat ratio and large airflow. It is configured with an infrared humidifier adjustable to different water qualities, and is compatible with R407C refrigerant to meet the requirement.

Liebert\_DM 16kW air conditioner comprises indoor unit and outdoor unit. With the standard condenser unit, the Liebert\_DM 16kW air conditioner can reduce noise pollution to the minimum while meeting system cooling requirement.

# 1.3 Main Components

#### 1.3.1 Indoor Unit

The indoor unit of the Liebert\_DM 16kW air conditioner includes compressor, evaporator, electric reheat, fan, controller, infrared humidifier, thermal expansion valve, sight glass and drier-filter.

#### Compressor

The Copeland scroll compressor features low vibration, low noise and high reliability. The connection mode of Rotalock makes the maintenance easier.

#### **Evaporator**

Finned tube evaporator with high heat dissipation efficiency is used. The distributor, with its model-specific design, ensures that the refrigerant is distributed evenly in each loop, improving the evaporator efficiency to a great extent.

#### Thermal expansion valve

The external equalizer type thermal expansion valve collects temperature and pressure signals at the same time, so that it can regulate the refrigerant flow more accurately.

#### Infrared humidifier

The infrared humidifier is designed with a simple structure, which is easy for teardown, cleaning and maintenance. It is adjustable to a wide range of water qualities, with fast startup and high humidifying efficiency.

#### Fan

The system uses centrifugal fan with high efficiency and reliability, large airflow and long blowing distance. With the belt transmission mechanism, it is easy for maintenance.

#### **Electric reheat**

The indoor unit adopts the PTC electric heater with a quick heating rate and even heat quantity.

#### Sight glass

The sight glass is the window for observing the system refrigerant recycle, mainly the moisture content of system. When the moisture content is too high, the color will change from green to yellow.

The filter drier can effectively eliminate the moisture in system within a period of time, filtrate the impurities generated during long-term system operation and ensure normal system operation.

#### 1.3.2 Outdoor Unit

The outdoor unit DMC16M2 condenser is applicable to Liebert\_DM 16kW air-cooled series.

The DMC16M2 condenser is the newly standard configuration outdoor unit of the Liebert\_DM 16kW AC. It adopts corrugated finned tube heat exchanger which features high heat dissipation efficiency, convenient cleaning and maintenance. External rotor axial fan with unique 'sickle' shape metal fan leaf has the superior aerodynamic property. The six and eight pole fan, with specially designed draught ring, makes the air flow noise through the fan leaf significant reduction. The high performance three-phase motor that is customized for the base station power grid environment can be applicable to the wide voltage range and has the higher reliability. The advanced fan speed control system regulates the voltage output by detecting the condensing pressure of the system to control the outdoor fan speed and make the system pressure and heat load adaptable. It makes sure that the AC unit can operate stably, reliably and efficiently.

#### 1.3.3 Controlling System

#### 1.3.4 Controller

The micro-processing controller of Liebert\_DM 16kW air conditioner uses the LCD screen with blue backlight and 240 x 128 pixels. The user interface operation is simple. The multi-level password protection can effectively prevent illegal operation. The controller also features power failure auto-restoration and high / low voltage protection function. The operation time of components is available through the menus. The expert-level fault diagnosis system can display the current fault information automatically, facilitating the maintenance. The controller can store 200 records of historical events. The panel of micro-processing controller is shown in Figure 1-2.



Figure 1-2 The panel of micro-processing controller

# 1.4 Environment Requirements

## 1.4.1 Operation Environment

See Table 1-1 for the details.

Table 1-1 Operation enviroment requirement

Item	Requirement
	Indoor: 0°C~40°C
Environment temperature	Outdoor:
	-15℃~+45℃
Protection level (outdoor unit)	IP55
Altitude	<1000m. Above that, derating is required
Operation voltage range	380V (-10% ~ +15%), 3N ~ 50Hz

## 1.4.2 Storage Environment

Table 1-2 Storage enviroment requirement

Item	Requirement	
Storage environment	Indoor, no dust	
Environment humidity	5%RH ~ 85%RH (non-condensing)	
Environment	_40°C∼+70°C	
temperature	400 1700	
Storage time	Total transportation and storage time should not exceed 6 months. Otherwise, the performance needs	
Storage time	to be re-evaluated	

# **Chapter 2 Mechanical Installation**

This chapter introduces the mechanical installation of the Liebert\_DM 16kW air conditioner, which includes transportation, installation arrangement and installation procedures.

# 2.1 Transportation, Unpacking And Inspection

#### 2.1.1 Transportation And Movement

Railroad transportation and shipping are the recommended means of transportation. If truck transportation is unavoidable, choose roads that are less bumpy in order to protect the equipment.

The Liebert\_DM 16kW air conditioner is heavy (see Table 2-1 for the weight parameters). It is recommended to use mechanical handbarrow such as electric forklift when unpacking and moving the equipment to the place most close to the installation site. Insert the tines of the forklift below the pallet, as shown in Figure 2-1. Align the tines to the center of gravity to prevent the unit from falling over.





Figure 2-1 Forklift removal

When moving the indoor unit, keep the obliquity within 75° ~ 105°, as shown in Figure 2-2.

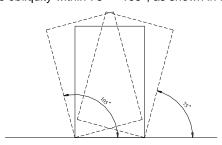


Figure 2-2 The obliquity of indoor unit

#### 2.1.2 Unpacking

Move the product to the place most close to the final installation site before unpacking the unit.

Follow the procedures below to unpack the unit:

1. Removing the side boards and top cover

Liebert\_DM 16kW air conditioner uses the international packaging. You can use a hammer or straight screwdriver to straighten the hook, as shown in Figure 2-3.





Figure 2-3 Straighten the hook

At first, straighten all the hooks that fix side board I, and remove side board 1. Then straighten all the hooks that fix side board 2, and remove side board 2. At last remove top cover 3, as shown in Figure 2-4.

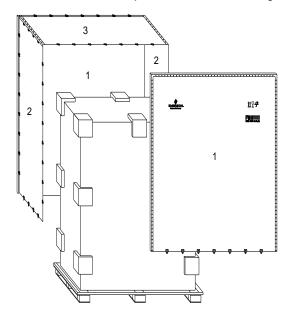


Figure 2-4 Remove side boards and top cover

#### 2. Removing the pallet

Liebert\_DM 16kW air conditioner is fixed onto the pallet with M10  $\times$  70 screws, as shown in Figure 2-5. You can use M10 open-end spanner, ratchet spanner or sleeve to remove the screws.

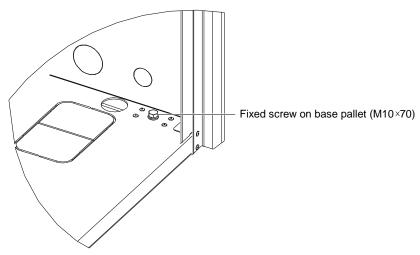


Figure 2-5 Screws on pallet

#### 2.1.3 Inspection

After receiving the product, you should check against the packing list. If any parts are found missing, distorted or damaged, please report to the carrier immediately. If any covert defects are found, please report to the carrier and the distributor.

#### 2.2 Installation Notes

To realize the designed performance and maximum product life, the installation must be correct. This section should be used in conjunction with local industry standards for mechanical and electrical installations.

Liebert\_DM 16kW air conditioner is designed for split floor installation. The indoor unit must be installed on the floor of the equipment room or computer room, and the outdoor unit can be installed outdoors or on the floor of other rooms. Before installation, make sure that the installation environment meets the requirements (see 1.4 Environment

Requirements) and the building should be transformed to accommodate the construction work of piping, wiring and

ventilation ducts.

Follow the design drawings strictly when installing the equipment, and reserve the space for maintenance. The manufacturer's engineering dimensions drawings can serve as a reference.

# 2.3 System Installation Arrangement

#### 2.3.1 General Arrangement

The general arrangement of Liebert\_DM 16kW air conditioner is shown in Figure 2-6.

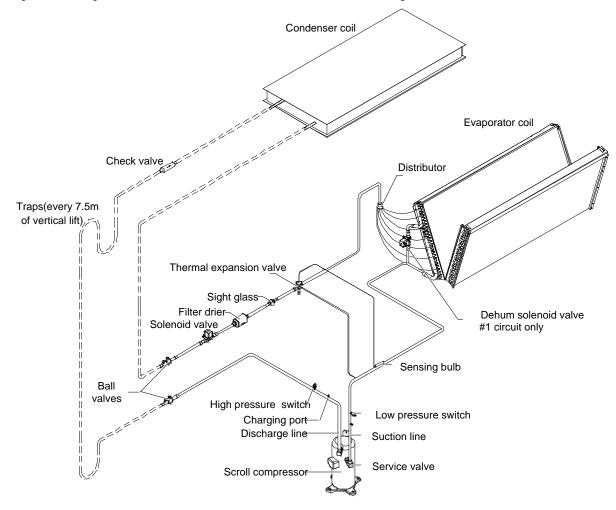


Figure 2-6 General arrangement diagram of air-cooled series

# Note 1. ====: Factory piping. 2. =====: Field piping (by others). 3. \*: Components are not supplied by Emerson but are recommended for proper circuit operation and maintenance. 4. +: Components are required when the equivalent length exceeds 30m.

#### 2.3.2 System Installation Sketch Map

The installation mode of air-cooled series unit is shown in Figure 2-7 and Figure 2-8.

#### Note

- 1. If the condenser is installed higher than the compressor, an external back bend should be fitted to the suction line and liquid return line of the condenser, so as to prevent the liquid refrigerant from flowing back when the condenser stops.
- 2. The top end of the back bend must be installed higher than the highest copper pipe of the condenser.

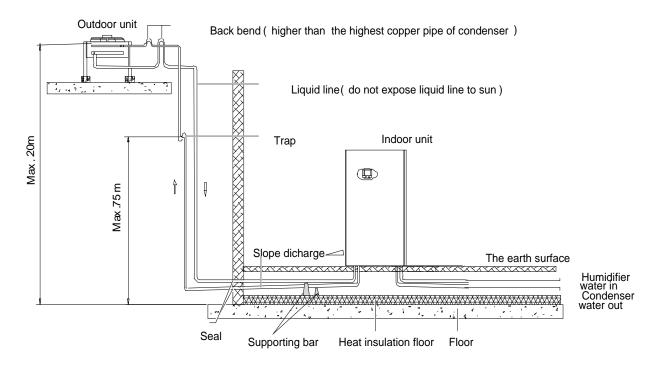


Figure 2-7 Condenser installed higher than compressor

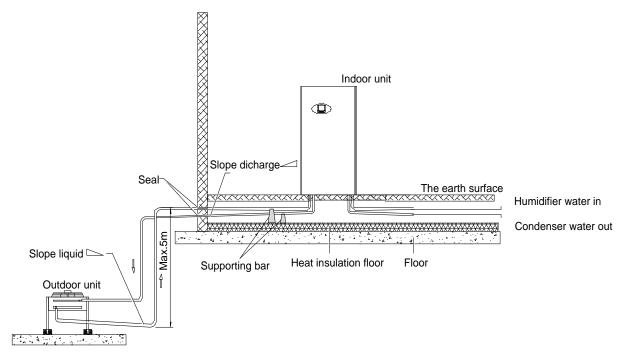


Figure 2-8 Compressor installed higher than condenser

#### 2.3.3 Mechanical Paremeters

#### Indoor unit

The mechanical parameters of the indoor unit are shown in Figure 2-9.

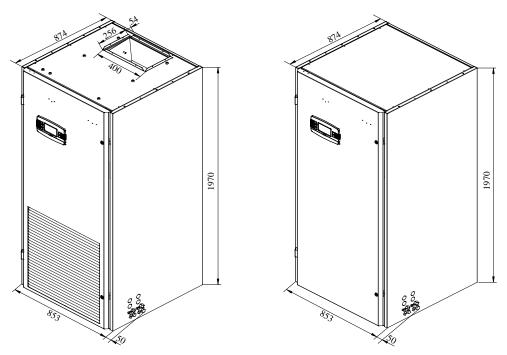


Figure 2-9 Mechanical parameters of the indoor unit

#### **Plenum**

You can select the air supply plenum with grids for the upflow system. The appearance of the plenum is shown in Figure 2-10. The dimensions are listed in Table 2-1.

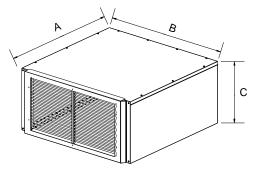


Figure 2-10 Appearance of the plenum

Table 2-1 Dimensions of plenum

Α	В	С
867	853	400 (600,optional)

#### Note

If the height of the plenum selected for air conditioner unit exceeds 600mm, consult the factory for non-standard production..

#### **Outdoor unit**

The appearance of outdoor unit is shown in Figure 2-11.

The dimensions and mechanical parameters of outdoor unit are shown in Figure 2-12.

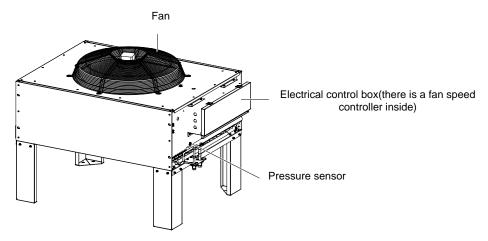


Figure 2-11 Appearance of outdoor unit

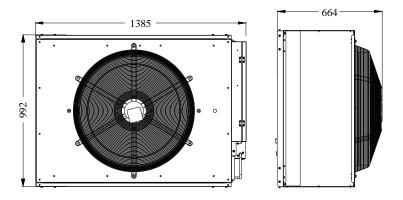


Figure 2-12 Dimensions and mechanical parameters of outdoor unit

# 2.4 Installing Indoor Unit

#### 2.4.1 Preparing Equipment room

The requirements of equipment room are as follows:

- 1. Damp proof and heat preservation must be done to make sure that the system can operate normally.
- 2. The equipment room should have good heat insulation and sealed damp proof layer. The damp proof layer of the ceiling and walls must use polyethylene film, and the coating of the concrete wall and the floor must be damp proof.
- 3. Prevent the outdoor air from entering the equipment room, because the outdoor air that enters the equipment room may increase the load of heating, cooling, humidifying and dehumidification of the system. It is recommended that the inhalation of outdoor air be kept below 5% of the total indoor airflow.
- 4. All the doors and windows should be closed and the seams should be as narrow as possible.

# 2.4.2 Installation Space

#### Note

Liebert\_DM 16kW air conditioner system will generate condensed water, and water leakage may damage the precision equipment nearby. So do not install the system in the vicinity of any precision equipment, and the installation site must provide draining pipes.

- 1. To ensure normal operation, the installation space for the indoor unit shall be capacious enough.
- 2. Too small space for the indoor unit will baffle the airflow, shorten the cooling cycle; the air supply and air exhaust may mix, and the decibel may rise.
- 3. Do not place the indoor unit in a concave or at the end of a strip area.
- 4. Do not huddle multiple indoor units, lest there should be mixed airflow, unbalanced load and competitive operation.

5. For the convenience of daily maintenance, do not install other equipment (such as smoke detector) above the cabinet.

Figure 2-13 shows the installation place of the indoor unit.

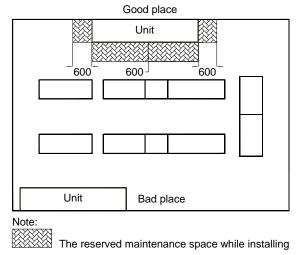


Figure 2-13 Installation place of indoor unit (unit: mm)

#### 2.4.3 Requirement Of Maintenance Space

Leave more than 600mm of maintenance space in the front and two sides of the indoor unit, as shown in Figure 2-13.

#### 2.4.4 Installation Procedures

The installation procedures of indoor unit are as follows:

1. Make the mounting base according to the dimensions in Figure 2-14 and the requirements in Table 2-2. You can make it by yourself or contact Emerson Network Power Co., Ltd. for non-standard production.

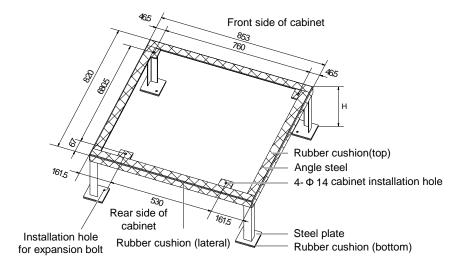


Figure 2-14 Mounting base of one bay series

Table 2-2 Specifications of indoor unit mounting base

	tem	Specification	Remark	
Steel plate	е	100mm × 100mm × (5 ~ 6.5)mm	-	
Angle stee	el	40mm × 40mm × 3mm	-	
Rubber	Тор	Thickness: 3mm ~ 5mm	-	
cushion	Lateral	Thickness: 2mm ~ 3mm	-	
Cusilion	Botton	Thickness: 10mm ~ 12mm	-	
Installatio expansion		-	Install the holes according to your requirements	
	One bay	H = 200mm (upflow unit)	The upflow unit do not need the flow deflector	
Н	Two bay	H = 300mm (downflow unit, according to the floor	The H dimension is only a reference. It should be determined accroding to your actual	
	Three bay	height)	requirements during making the mounting base	

#### Note:

The external side boards of the unit cannot bear weight. Take this into consideration while selecting angle steel and fixing holes As the value of H exceeds 450mm, please strengthen the mounting base or contact Emerson Network Power Co., Ltd.

- 2. Lay a layer of rubber cushion on the top, lateral of mounting base and on the bottom of the steel plate respectively. See Figure 2-18, Figure 2-19 and Figure 2-20 for their positions and see Table 2-3 for the thickness.
- 3. Identify the installation position. Fix the mounting base onto the mounting base according to the site conditions and your requirement.
- 4. Fix the AC unit onto the mounting base with nuts, spring washers, flat washers and bolts.

# 2.5 Installing Outdoor Unit

#### 2.5.1 Installation Notes

The installation notes of the condenser are as follows:

- 1. To ensure the heat dissipation capacity, install the condenser in the place with smooth air flow. Do not install it where the coil of the condenser may be obstructed by dust and snow. Ensure that there is no steam or waste heat around.
- 2. If possible, the horizontal installation is recommended to reduce the noise.
- 3. The condenser should be installed as far away as possible from residential areas (≥15m).

- 4. Be careful not to damage the waterproof layer and observe the local rules and regulations when the condenser is installed on the roof of building.
- 5. Position the condenser higher than the indoor unit to ensure normal oil return.
- 6. Follow the installation arrows on the condenser for the installation direction.

#### 2.5.2 Space Requirements

#### ■ Note

- 1. A 4000mm clearance is required around the condenser air outlet.
- 2. The 600mm service spaces are required on the four sides of the condenser.

The condenser needs sufficient installation and service space around the installation place. The detailed space requirements are shown in Figure 2-15 and Figure 2-16.

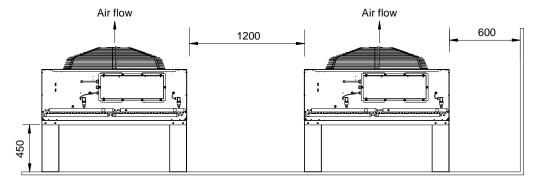


Figure 2-15 Horizontal installation space requirement (unit: mm)

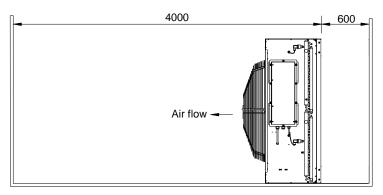


Figure 2-16 Vertical installation space requirement (unit: mm)

#### 2.5.3 Mounting base dimension

#### Mounting base for horizontal installation

The mounting base for horizontal installation is shown in Figure 2-17 and the mounting base dimensions of each model are listed in Table 2-3.

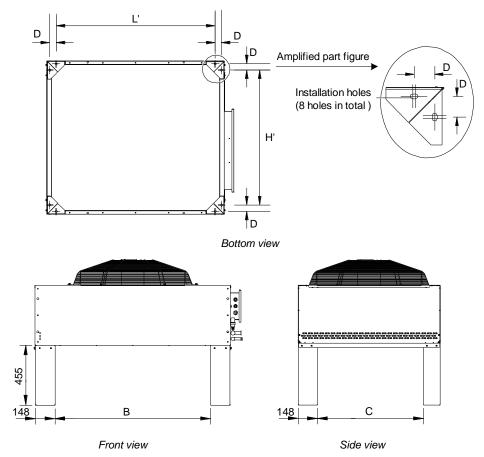


Figure 2-17 Mounting base dimensions for horizontal installation (unit: mm)

Table 2-3 Mounting base dimensions for horizontal installation (unit: mm)

Model	Dimension $(L' \times H' \times D)$	В	С
DMC16M2	1126 × 837 × 53	980	691

#### Note

The installation holes are long and flat holes. It is recommended to use M10 x 20 bolts to fix the mounting base.

#### Mounting base for vertical installation

The mounting base for vertical installation is shown in Figure 2-18, and the dimensions of each model are listed in Table 2-4.

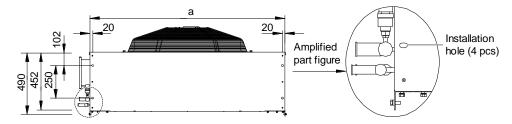


Figure 2-18 Mounting base dimensions for vertical installation (top view) (unit: mm)

Table 2-4 Mounting base dimensions for vertical installation (unit: mm)

Model	Dimension 'a'
DMC16M2	1280

#### Note

- 1. The installation holes are long and flat holes. It is recommended to use M10  $\times$  20 bolts to fix the mounting base.
- 2. When one condenser needs to be installed on another one, the upper condenser must be installed on a rack and cushion pads should be used between the condenser and the rack for damping. It is prohibited to stack two condensers and bolt them together directly.

# 2.6 Piping

All joints of the cooling pipes must be silver brazed. Standard industry procedures must be followed in selecting, laying, and fixing the pipes, and in vacuuming the system and charging refrigerant. Take pipeline pressure drop, oil return to the compressor and minimization of noise and vibration into consideration during the design and construction.

#### 2.6.1 General

The recommended pipe sizes are 'equivalent lengths' (see Table 2-5 for equivalent lengths of partial components), which has included the resistance brought about by bends. You should confirm that the sizes are appropriate for the site conditions

1. If the one-way equivalent length exceeds 30m, or if the vertical difference between indoor unit and outdoor unit exceeds the values in Table 2-5, consult the factory before installation for confirmation whether extended components are needed.

Table 2-5 Vertical difference between indoor unit and outdoor unit

Relative position	Value
Indoor unti lower than outdoor unit	Max.: +20m
Outdoor unit lower than indoor unit	Max.: -5m

2. The pipe sizes recommended in Table 2-6 are 'equivalent lengths', which has included the resistance brought about by bends and valves. You should confirm that the sizes are appropriate for the site conditions.

Table 2-6 Equivalent lengths of partial components

Outer Diameter (OD) of		Equivalent length (m)		
liquid pipe (inch)	90°bend	45°bend	T type three way	
3/8	0.21	0.10	0.76	
1/2	0.24	0.12	0.76	
5/8	0.27	0.15	0.76	
3/4	0.3	0.18	0.76	
7/8	0.44	0.24	1.1	
1-1/8	0.56	0.3	1.4	

#### □ Note

A trap is required for every 7.5m of vertical lift. Please consult the factory for detailed information.

#### **Connecting pipes**

The pipes to connect include:

- 1. Cooling water drain-pipe of indoor unit
- 2. Water supply pipe of infrared humidifier
- 3. Connecting copper pipe (exhaust pipe and liquid return pipe) between indoor unit and outdoor unit
- 4. Installing extension subassembly (optional)
  - Connecting cooling water drain-pipe of indoor unit

The cooling water of infrared humidifier and evaporator is converged by the cross connector and drains through the draining pipe, as shown in Figure 2-19. The OD of the pipe is 25mm. If the draining pipe is used by three or more units, the minimal OD of the pipe should be 40mm.

#### Note

Because the humidifier contains boiling water, the plastic pipe must be rated higher than  $90^{\circ}$ C.

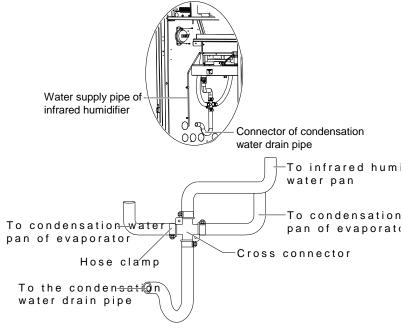


Figure 2-19 Connection of drain pipe

#### Note

- 1. A  $\Phi$ 25 hose clamp is delivered as an accessory to connect the draining pipe.
- 2. When connecting the draining pipe, make sure that the U bend is installed vertically and the 'U' shape is not distorted, so as to ensure that the cooling water can be drained immediately and effectively.

#### Connecting water supply pipe of infrared humidifier

The water pipes should be connected for the infrared humidifier. To facilitate maintenance, a strainer / non-return isolation valve is fitted to the supply water pipe. The infrared humidifier water supply pipe reserves a copper pipe (OD: 6.35mm, see Figure 2-20) with a 1/4" copper nut at the end of the pipe. Take out of the 1/4" × 1/2" screw-thread copper connector from the accessory bag and screw the connector onto the copper pipe. You can also select other connection modes according to the site condition. Make sure the connection is well sealed to prevent leakage. The pipe pressure is 100kPa.

Where the main pressure may rise above 700kPa, a pressure reducer should be fitted. Where the pressure falls below 100kPa, a water tank and pump system should be used.

#### ■ Note

Main water supply connections must be made in accordance with local laws and regulations.

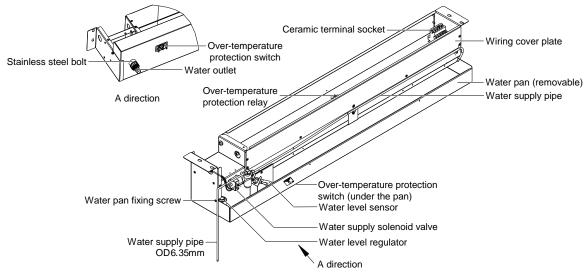


Figure 2-20 Infrared humidifier

• Connecting copper pipe (exhaust pipe and liquid return pipe) between indoor unit and outdoor unit

The indoor unit and outdoor unit are connected through welded copper pipes. The connection of discharge pipe / liquid pipe of indoor unit is shown in Figure 2-21. Note that the ball valve must be wrapped with a wet cloth before welding. In addition, many notes and instruction labels are pasted onto the base board and side board close to the ball valve. Do not have them burned during the welding operation.

#### Note

The exposure time of system pipes do not exceed 15min. Otherwise, it will lead to the POE refrigeration oil moisture effect the life of the key components and the system operation stability.

Horizontal sections of discharge pipes should be sloped downward from the compressor, with a slope of at least 1:200 (5mm down for each 1m run). Discharge pipes should be heat insulated where they are routed in the conditioned space (including under a raised floor).

The liquid pressure drop should not exceed 40kPa (5psi ~6psi), provided that there is no loss of refrigeration. The liquid line pressure drop is the sum of liquid flow resistance from the tubing and fitting (including the drier), plus the loss of head pressure due to elevation above the condenser. If the liquid temperature is 38°C, the static pressure loss is 11kPa (1.6 psi) per meter of lift.

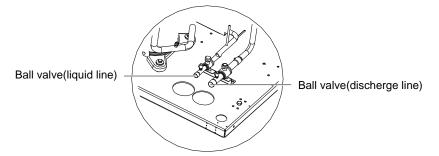


Figure 2-21 Connection of discharge pipe / liquid return pipe

Considering the effect of the pipe OD to the system pressure drop, the pipe OD of indoor unit and outdoor unit should be determined according to the specifications listed Table 2-7.

Eq.Lgth	D	L
10m	22	13
20m	22	13
30m	22	13
40m*	22	13
50m*	22	13
60m*	22	16

Table 2-7 Recommended pipe sizes

#### Note

- 1. Extension subassembly should be added to the "Eq.Lgth" marked with \*.
- 2. D: discharge line, L: liquid line.
- 3. Consult factory if the line length exceeds 60m.
  - Installing the extension subassembly (be applicable to site installation)

When the equivalent length of pipe exceeds 30m, the extension subassembly should be installed. It is recommended to install the solenoid valve of the extension subassembly to the outside project pipe of the ball valve on the liquid pipe, or the outer side (or on the bottom) of the unit.

So, during installing the solenoid valve, you need not to cut the indoor unit pipes. After the whole system is installed, you can open the ball valve to keep pressure and carry out vacuum operation, avoiding the moisture absorption of the compressor refrigeration oil and ensuring the operation safety and life of the compressor. For installation valve of the check valve, refer to Figure 2-6.

#### 2.6.2 Charging refrigerant and adding refrigerant oil

#### 1. Charging with refrigerant

The Liebert\_DM 16kW air conditioner had been charged with 2bar nitrogen to keep pressure at the factory. In project installation, see the unit nameplate for the initial charging capacity of Liebert\_DM 16kW air conditioner.

If the connecting pipe between the indoor unit and the outdoor unit is longer than 10m, add refrigerant to the system in order to ensure normal system operation.

The amount of the refrigerant is calculated through the following formula:

Refrigerant amount (kg) = unit length liquid pipe refrigerant amount (kg/m) x length of extended pipe (m)

See Table 2-8 for the unit length liquid pipe refrigerant amount.

Length of extended pipe (m) = Total length of liquid pipe (m) - 10m

Table 2-8 Unit length liquid pipe refrigerant amount of pipes with different ODs

Pipe OD (mm)	Unit length liquid pipe refrigerant amount (kg/m)	Pipe OD (mm)	Unit length liquid pipe refrigerant amount (kg/m)
9.52	0.060	19	0.261
12.7	0.112	22	0.362
16	0.181	28.6	0.618

#### 2. Adding POE refrigerant oil

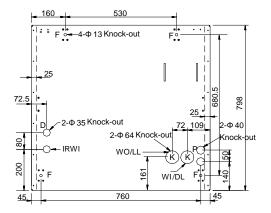
The added refrigerant will dilute the POE refrigerant oil in the system, undermining the lubricating and cooling effects of the POE refrigerant oil. Therefore more POE refrigerant oil should be added. See the formula below:

Amount of refrigerant oil to be added (ml) = amount of added refrigerant (kg) x 22.6

## 2.7 Base/Side Panel Cutout Locations

#### **Base cutout locations**

Figure 2-22 and Figure 2-23 show the base figures with the side panel removed, and the distance between the dashed lines and the rear panels is 25 mm, where is the mounting place of inner side panel.



IRWI: Infrared humidifier water in

D: Drain

P: Power cable entry (Φ30)

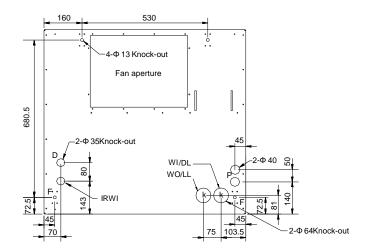
F: Unit set screw

K: Knock-out

LL/DL: Liquid line / discharge line (air-cooled models)

WI/WO: Condenser water inlet and outlet (water-cooled models)

Figure 2-22 Base cutout location of upflow models



P: Power cable entry

IRWI: Infrared humidifier water in

F: Unit set screw

= 11 %

D: Drain

K: Knock-out (250 × 120)

LL/DL: Liquid line / discharge line (air-cooled models)

WI/WO: Condenser water inlet and outlet (water-cooled models)

Figure 2-23 Base cutout location of downflow models

#### Side panel cotout locations

The knock-out dimensions of side panels are shown in Figure 2-24 and Figure 2-25.

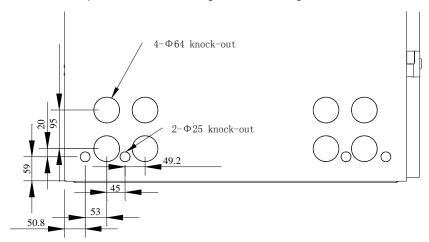


Figure 2-24 Left side panel

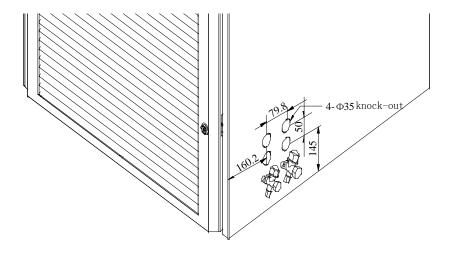


Figure 2-25 Right side panel

# 2.8 Removing Transport Fastener And Vibration Absorber

In order to protect partial components from damaging and distorting due to bumping, impact and resonation, fasteners and vibration absorbers are mounted at certain locations before delivery. Remove the fasteners and vibration absorbers before installation and commissioning.

#### Removing transport fixing plate from the compressor

To reduce the compressor operation vibration and noise, the vibration absorbing cushions are added to the compressor base. However, such device cannot best restrain the equipment vibration during the transportation, resulting in loosened connections and wearing of certain parts. To counteract such effect, three L shaped plates are added to the compressor base during the transportation, as shown in Figure 2-26.

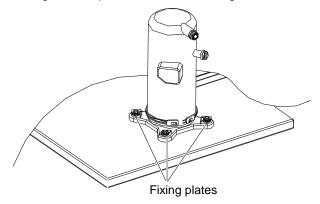


Figure 2-26 Compressor fixing plates

After the installation and before the commissioning, remove the three fixing plates, then restore the washers and bolts. The fastening torque of the bolts is  $(12 \pm 1)$ N·m.

#### Removing transport fastener of fan compoents

#### 1. Upflow unit

The motor base of the fan is designed with a semi-free self-tension structure to minimize the fan operation noise and prolong the belt life. During the transportation, to protect the semi-free structure from failing or collapsing due to resonation, the upflow unit is especially fastened with bolts (left and right symmetrical, two at either side), as shown in Figure 2-27. You should cut the binding string on the belt and remove the four fixing bolts before the power-on operation, otherwise the fan could be damaged and even cause personal injury. Removing the bolts requires the collaboration of two persons, with one holding the motor and the other removing the bolts.

#### ■ Note

After you open the front door of unit, you will see a warning label concerning bolt removal on the sealing panel of the fan. Do remove the bolts by following the preceding instructions.

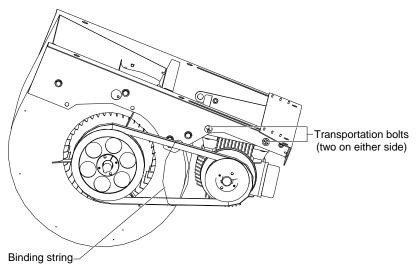


Figure 2-27 Fixed bolts and trap wrench of transport fan components

#### 2. Downflow unit

During the transportation, some cushion foam is inserted into the triangle formed by the motor base and the fan. Remove the foam before the power-on operation.

#### Warning

Never put hands into the triangle gap between the motor base and fan.

#### Removing the transport components of infrared humidifier

#### Warning

Removal of the transport protection foam may cause fire.

In order to protect the infrared humidifier pump from rupturing during transportation, the protection foam is fitted to the infrared humidifier components before delivery. Before the unit operation, remove the protection foam and connect the cable of the high water-level test switch. If you do not operate following the instruct bellow, the infrared humidifier will not work normally and even the fire may be caused.

The detailed operation procedures are as follows:

1. Cut the cable tie and remove the protection foam fixed under the pump, as shown in Figure 2-28 and Figure 2-29.



Figure 2-28 Removing protection foam

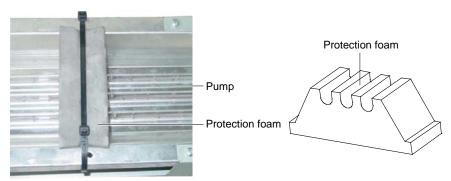


Figure 2-29 Protection foam

2. Remove four self-tapping screws and remove the front cover plate of the infrared humidifier connection box, as show in Figure 2-30.

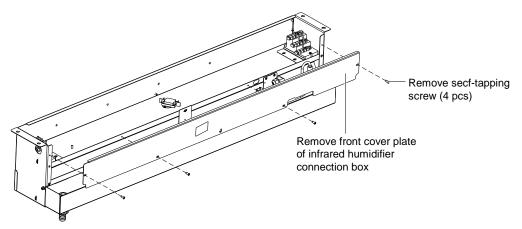


Figure 2-30 Removing front cover plate of infrared humidifier connection box

3. Lead the cable of high water-level test switch through the cable hole (see Figure 2-28) and insert the cable terminal into the HWA cable terminal in the connection box, as shown in Figure 2-31.

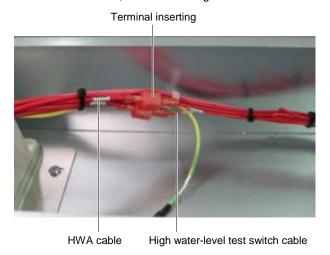


Figure 2-31 Inserting cable terminal of high water-level test cable into HWA cable terminal

- 4. Restore the front cover plate of the infrared humidifier connection box and fasten the self-tapping screws.
- 5. Remove the rubber string bound on the floating pole and the high water-level test switch.

The floating pole and the infrared humidifier high water-level test switch are tightly bound together with a rubber string before delivery, as shown in Figure 2-32. Remove the rubber string before the unit operation. Otherwise, the unit cannot test the high water-level alarm.



Figure 2-32 Floating pole of high water-level test switch and rubber string positions

#### Removing fastener of pipes

During the transportation, to prevent the long copper pipes from scratching the metal plate and get damaged, the pipes are cushioned with foam or bound up before delivery. Remove those materials before the power-on commissioning.

# 2.9 Component Adjustment

#### Water level regulator

The water level regulator of the infrared humidifier is screwed down completely. Before the commissioning, unscrew the water level regulator till its head is 45mm above the water pan bottom, as shown in Figure 2-33.

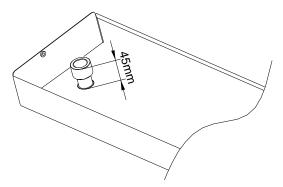


Figure 2-33 Water level regulator adjustment

# 2.10 Installation Inspection

After the mechanical installation is completed, you should check:

- 1. A certain space is left around the unit for maintenance.
- 2. The equipment is installed vertically and the installation fasteners have been fixed.
- 3. The pipes connecting the indoor unit and outdoor unit have been connected, and the ball valves of indoor unit and outdoor unit have been opened completely.
- 4. The condensate pump (if needed) has been installed.
- 5. The draining pipe has been connected.
- 6. The water supply pipe for infrared humidifier has been connected.
- 7. All pipe joints have been fixed.
- 8. The transport fasteners have been removed.
- 9. The water level regulator of the infrared humidifier has been unscrewed to the required height.
- 10. The debris (such as transportation material, structure material and tools) inside or around the equipment has been cleaned.

After confirming the preceding points, you can then start the electrical installation.

# **Chapter 3 Electrical Installation**

This chapter introduces the electrical installation of the Liebert\_DM 16kW air conditioner, which includes work introduction, installation notes, wiring of indoor unit, connecting power cables for outdoor unit and installation inspection.

#### 3.1 Work Introduction And Notes

#### Wires to connect on-site

- 1. The power cable of indoor unit.
- 2. Outdoor unit (air-cooled): standard signal cable.
- 3. Input and output control cables.

#### **Notes**

- 1. The connection of all power cables, control cables and ground cables should comply with local electrician regulations.
- 2. See the equipment nameplate for the full load current. The cable sizes should meet the local wiring rules.
- 3. Mains supply requirement: 380Vac, 50Hz.
- 4. The electrical installation must be completed by trained personnel.
- 5. Before the wiring, use a multimeter to measure the power supply voltage and make sure that the power supply has been switched off.

# 3.2 Wiring Of Indoor Unit

#### 3.2.1 Locating Electrical Interface Of Indoor Unit

Open the front door of the indoor unit, and you will see the interfaces of the electrical control box, as shown in Figure 3-1.

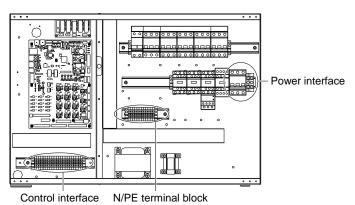


Figure 3-1 Interfaces of electrical control box of one-bay system

#### 3.2.2 Connecting Power Cable Of Indoor Unit

The power interfaces are located as shown in Figure 3-1, Figure 3-2 and Figure 3-3. The power interface is amplified as shown in Figure 3-4. Connect terminals  $L1 \sim L3$ , N, and PE to their counterparts of external power supply.

Fix the input cables to the cable clamp, as shown in Figure 3-5. As for the cable specification, see the unit maximum operation current in Table 3-1.

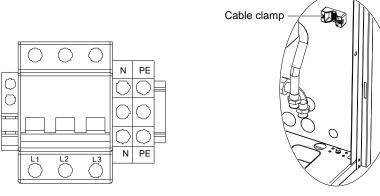


Figure 3-2 Amplified figure of power supply interface

Figure 3-3 Cable clamp

#### ■ Note

The cable sizes should meet the local wiring rules.

Table 3-1 System maximum operation current (unit: A)

Model	Maximum operationi current
upflow unit	23.1
downflow unit	23.1

#### 3.2.3 Connecting Control Cables

The control interfaces are located as shown in Figure 3-1, Figure 3-2 and Figure 3-3. The control interface is amplified in Figure 3-6. The upper part of the terminal block is connected to the system, while the lower part is used as user control signal interfaces.

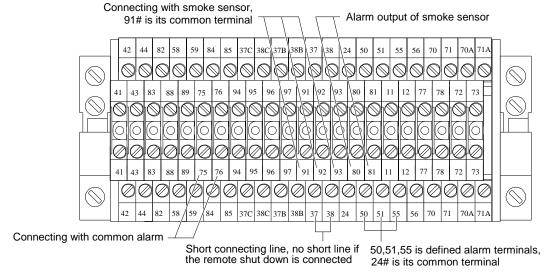


Figure 3-4 Control interfaces

#### Note

The wiring personnel must take antistatic measures before wiring the control cables.

#### Water-under-floor sensor

Every unit is supplied with one water sensor. You should connect one end of the sensor to terminal 51, and the other end to the common terminal 24. The number of sensors in parallel connection is not limited, but there is only one water alarm for each unit.

#### Remote shutdown

Terminals 37 and 38 can be connected to the remote shutdown switch. By default, terminals 37 and 38 are shorted. Remove the shorting wire if a remote shutdown signal is needed.

#### Note

When terminals 37 and 38 are open, the unit is shut down.

When two remote shutdown signals are to be connected, connect the connection cable 39-3# of the control board to terminal 37B#, instead of 37#, and series connect the terminals 38B# and 37# (the cable is not provided). Then the second remote shutdown signal is connected through the terminals 37B# and 38B# on lower side of the terminal block. When three remote shutdown signals are to be connected, connect the connection cable 39-3# of the control board to terminal 37C#, instead of 37#, and series connect the terminals 38B# & 37# and 38C# & 37B# (the cables are not provided). Then the second and third remote shutdown signals are respectively connected through terminals 37B# & 38B# and 37C# & 38C# on lower side of the terminal block.

#### Smoke sensor

The smoke sensor can be connected to terminals 91, 92 and 93, with 91 being the common terminal, 92 being the NO contact, and 93 the NC contact. You can select NO or NC contact according to the smoke sensor logic.

Terminals 80 and 81 are used to output external alarms for the smoke sensor.

#### Control signals of outdoor unit

Terminals 70, 71, and terminals 70A, 71A are two pairs of control signal input terminals of outdoor unit. Their on/off state is the same as that of the compressor.

#### **Customized alarm terminals**

Terminals 50, 51, 55 can be connected to three kinds of sensors, including fire sensor and water sensor. Terminal 24 is the common terminal. After connecting sensors to the terminals, you should set the corresponding customized alarm through the microprocessor. See 错误!未找到引用源。错误!未找到引用源。 for details. When the contactor is open and there is no external alarm, the input state of the customized terminal is open. But when the contactor is closed and the external alarm is raised, the input state of the customized terminal will be shorted. At this time, the system will raise sirens, and the LCD of the controller will display the alarm information. If a PC installed with Emerson monitoring software is connected to the system, the alarm will also be displayed on the PC.

The terminals can be defined as follows:

Terminals 50 and 24: remote alarm.

Terminals 51 and 24: water sensor (by default).

Terminals 55 and 24: safe switch for condensation water pump (optional).

#### **External alarm terminals**

Terminals 75 and 76 can be used as external alarm terminals. They are controlled by the external alarm relay K3 on the circuit board. They output signals to external alarm devices, such as the alarm indicator. When critical alarm occurs, the contactor will close to trigger remote alarms, send signals to the building management system or dial the paging system automatically. The power supply of the external alarm system is user self-prepared.

Refer to Appendix 2 Circuit Diagram of DME16 for the detailed definition of other terminals.

#### 3.2.4 Connecting Extension Component Solenoid Valve (For Site Installation)

The extension subassembly solenoid valve has three connection cables, two of which are control cables (brown) used to connect with the corresponding terminals of control board and one of which is ground cable used to connect the ground terminal block. Note that the solenoid valve cables of 1# system and 2# system in double system unit should be remarked for voiding wrong connection. For detailed terminal positions, refer to the LLSV1 and LLSV2 connection terminal No. in *Appendix 2 Circuit Diagram of DME16*.

# 3.3 Wiring Of Outdoor Unit

#### 3.3.1 Connecting Power Cables For Outdoor Unit

#### 1. Identifying the cable specifications

Select the power supply cables and the start/stop signal cables of the condenser according to the fan rated operation current (see Table 3-2) and the site conditions, such as the distance between indoor unit and condenser.

Table 3-2 Operation current of fan under 380V voltage

Condenser Model	Rated current (A)
DMC16M2	1.65

#### Note

- 1. The 20AWG (0.52mm<sup>2</sup>) start / stop signal cable of the condenser is recommended.
- 2. The protected tube or shielded line is required for the outdoor part of the connection cable between the indoor unit and the condenser. The ground cable should be connected to the ground nearby, and the length cannot exceed 3m.
- 3. The cables cannot contact with hot objects, such as the copper tube and water pipe without insulation, to avoid damaging the insulation layers.
- 4. The cables should be connected in accordance with the local regulations.

#### 2. Connecting cables

See Figure 3-5 and Appendix 3 Circuit Diagram of DMC16M2 for the connections of external power cables.

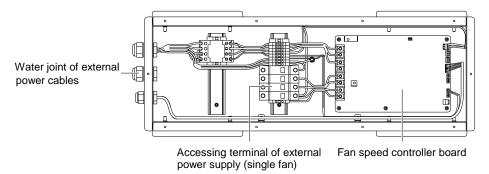


Figure 3-5 Connection figure of single fan external power cables (taking LDF42 for example)

#### Note

- 1. The external power lines and compressor signal lines enter the electrical controlling box through the water joint of external power cables whose inside diameter is  $\Phi$ 10mm.
- 2. After connecting the external power lines, the waterproof sealant treatment is required to ensure the good waterproof performance of electrical controlling box.
- 3. The phase order of three-phase AC input (L1, L2, L3) must be correct. Otherwise, the fan speed controller will generate the phase loss alarm, and there will be no AC output.

#### 3.3.2 Connecting Control Signal Cables Of Outdoor Unit

The wiring terminals are located on the fan speed controller board (see Figure3-5). Their distribution is shown in Figure3-6 and the definitions are listed in Table3-3. Refer to *Appendix 3 Circuit Diagram of DMC16M2* for detailed connections.

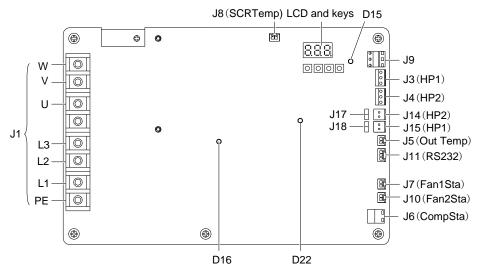


Figure 3-6 Layout of wiring terminals

Table 3-3 Definitions of wiring terminals

Silk print	Definition	Definition of pins	
J1	AC I/O terminal	PE: protection earth L1, L2, L3: three-phase AC input U, V, W: three-phase AC output, which connects with the power supply terminals The middle terminal pin without logo is reserved	
J9	Passive dry contactor relay output (for the power switch of fan power supply contactor)	Pin 1: normally closed terminal of relay, which is reserved Pin 2: common terminal of relay, which is used for AC input Pin 3: normally open terminal of relay, which is used for AC output	
J3 (HP1)	Input terminal of voltage pressure sensor 1 (spare)	Pin 1: positive terminal of 5V power Pin 2: input terminal of 0.5V ~ 4.5V pressure voltage signal	
J4 (HP2)	Input terminal of voltage pressure sensor 2 (spare)	Pin 3: negative terminal of 5V power	
J15 (HP1)	Input terminal of current pressure sensor 1	Pin 1: positive terminal of 12V power	
J14 (HP2)	Input terminal of current pressure sensor 2	Pin 2: input terminal of 4mA ~ 20mA pressure current signal	
J17, J18	Shorting jumpers of current pressure sensor	Current pressure sensor: the short circuit ring must be installed on the shorting jumpers  Voltage pressure sensor: the open state of short jumpers must be kept	
J5 (Out Temp)	Input terminal of environment temperature sensor (spare)	Pin 1: input terminal of temperature signal Pin 2: signal ground	
J11 (RS232)	Serial communication interface (used for maintenance)	Pin 1: communication ground Pin 2: reception terminal of communication Pin 3: transmission terminal of communication	
J7 (Fan1Sta)	Detecting terminal of fan 1 over temperature state	Pin 1: output terminal of 19V AC signal	
J10 (Fan2Sta)	Detecting terminal of fan 2 over temperature state	Pin 2: return terminal of 19V AC signal	
J6 (CompSta)	Detecting terminal of compressor state		

#### 3.3.3 Installation Inspection

After the electrical installation is completed, you should check and confirm that:

- 1. The power resource voltage meets the rating on the nameplate.
- 2. The system electric loop has no open circuit or short circuit.
- 3. Power cables and grounding cables are connected to the circuit breakers, indoor unit and outdoor unit.

- 4. The ratings of the circuit breakers and fuses are correct.
- 5. The control cables are properly connected.
- 6. All the cables connections are fastened, with no loose screws.

You can start commissioning after confirming the preceding points.

#### 3.3.4 HMI

The fan speed controller can realize the HMI function through indicators, RS232 serial communication port, keys and LCD.

#### **Indicators**

There are three indicators (see Figure 3-6) on the fan speed controller board. See Table 3-4 for the functions of indicators.

Silk print	Definition	Color	State	Function
D16 Power indicator	Power indicator	Green	On	The CPU circuit of fan speed controller board is supplied with 5V power
	•	Off	There is a faulty on fan speed controller board	
			On or off	There is a faulty on fan speed controller board
D22 Run indicator	Run indicator	dicator Green	Blinking at 1Hz (slowly)	The system is running normally without alarm
			Blinking at 5Hz (quickly)	There is an alarm or the compressor is shut down
D15 I	Power switch controlling indicator of AC contactor	Red -	On	The control switch which supplies the AC contactor with the driving power is open
			Off	The control switch which supplies the AC contactor with the driving power is closed

Table 3-4 Functions of indicators

#### **RS232 serial communication port**

RS232 serial communication port provides a port to interface the computer using factory-defined protocol. It is used in factory commissioning and maintenance.

#### **Keys and LCD**

The keys and LCD, which can realize the functions in Table 3-5, provide the HMIs for maintenance personnel. Refer to 错误! 未找到引用源。错误! 未找到引用源。for the detailed operations of keys and LCD HMI.

NO.	Function	Description
1	Inquire the acquisition data in real time	The inquiried acquisition data includes condensing pressure, environment temperature, SCR temperature, output percentage
2	Inquire the current alarm data in real time	The inquiried current alarm data includes phase loss alarm, SCR over temperature, fan 1 over temperature, fan 2 over temperature, pressure sensor failure, EEPROM read fault alarm, SCR temperature sensor failure and abnormal frequency
3	Inquire the historical alarm data in real time	The present 100 historical alarms saved can be inquiried
4	Change the configured parameters in real time	The changeable configured parameters include running pressure, pressure controlling range, minimum voltage, maximum voltage, fan number, pressure sensor type; or resume the default values

Table 3-5 Function descriptions of keys and LCD

The keys and LCD are on the upper right corner of the fan speed controller, as shown in Figure 3-6. Their appearance is shown in Figure 3-7.

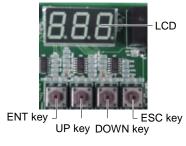


Figure 3-7 Keys and LCD

#### 3.3.5 Operation Description Of HMI

#### **Initial Interface**

The LCD will display alternately 'F01' and the bigger one of condensing pressure 1 and condensing pressure 2 when the fan speed controller is powered on initially. The 'F01' is the maximum pressure logo. However, the pressure value will be displayed as '88.8' on the LCD upon the following occasions:

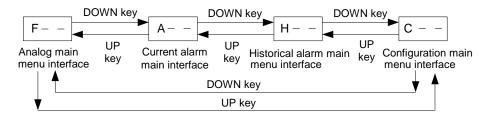
- 1. The pressure sensor is not installed,
- 2. The short jumper cap of current pressure sensor is not installed.
- 3. The pressure sensor is disabled.

The show order is shown in the following figure (the '16.1' is only an example, and the actual value is determined by the sampling result).



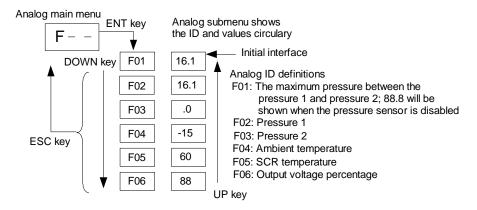
#### **Main Menu Interface**

Press the ESC key on the initial interface, the main menu interface will appear on the LCD. The main menu interface includes the analog main menu interface, current alarm main interface, historical alarm main menu interface and configuration main menu interface. Press the UP key and DOWN key to select the different main menu interface, and press the ENT key to enter the submenu of the current main menu on the main interface. The switching operation processes and orders of the main menus are shown in the following figure.



### Analog main menu interface

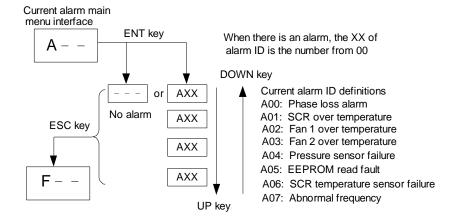
Press the ENT key to enter the analog submenu interface when the current main interface shows 'F--' (the symbol of analog main menu). The switching operation processes and orders of the analog submenu are shown in the following figure.



#### **Current alarm main interface**

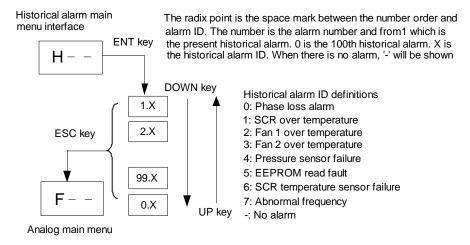
Press the ENT key to enter the current alarm submenu interface when the current main interface shows 'A--' (the symbol of current alarm main menu). The switching operation processes and orders of the current alarm submenu are shown in the following figure.

See Table 6-3 for generating conditions and troubleshooting.



#### Historical alarm main menu interface

Press the ENT key to enter the historical alarm submenu interface when the current main interface shows 'H--' (the symbol of historical main menu). The switching operation processes and orders of the historical main menu are shown in the following figure.

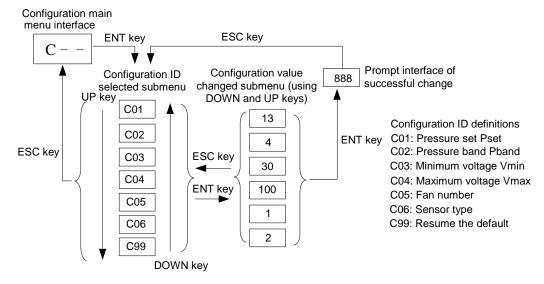


# Configuration data main menu interface

#### ☐ Note

The configuration data main menu interface is designed only for maintenance personnel to set parameters, others are prohibited to operate it.

Press the ENT key to enter the configuration data submenu interface when the current main interface shows 'C--' (the symbol of configuration data main menu). The switching operation processes and orders of the configuration data main menu are shown in the following figure.



# Chapter 4 System Start-Up And Commissioning

This chapter introduces the power-on commissioning and function test of air-cooled series and water-cooled series, including the preparation before commissioning and commissioning procedures.

# 4.1 Location Of MCBs

The MCBs are located as shown in Figure 4-1.

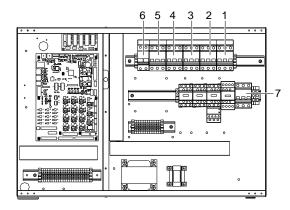


Figure 4-1 MCB of one bay system

- 1: Compressor MCB
- 3: Electrical heater MCB
- 5: Outdoor unit (air-cooled) MCB
- 7: Main isolation switch

- 2: Fan MCB
- 4: Infrared humidifier MCB
- 6: Control board MCB

# 4.2 Power-on Commissioning

### 4.2.1 Preparation Before Commissioning

## **Mechanical part**

- 1. Check that the protection materials for transportation have been removed. For the upflow series unit, check that the transportation bolts of the fan have been removed; check that the motor pulley and the fan pulley are fixed, the motor bearing and fan bearing are parallel, the belt is perpendicular to the two bearings and the tension of the belt is proper.
- 2. The cooling pipe system has past the pressure leak test.
- 3. The total charge has been roughly calculated. If the pipe is too long, the rated amount of refrigerant oil should have been charged into the system.
- 4. The water supply & drain pipe-system of the humidification system has been reliably connected, the material requirement is met and the leak detection has been done.
- 5. The heating tape of the compressor has been preheated for over 12hr.
- 6. Make sure the equipment room is above 20°C with certain heat load. Otherwise, pre-heat the equipment room with any heating device, or by forcedly running the heaters of the unit (in this case, go through the following procedures till the third entry of 4.2.2 Commissioning Procedures first) and of other equipment in the room. Ensure sufficient heat load for the commissioning.
- 7. In the winter, it may be necessary to manually raise the condensing pressure to 16Bar by manually shielding some condensing area and limiting condensing air quantity.

### **Electric part**

- 1. Check that the voltage of the main power supply is within ±10% of the rating, and that the isolation switch of the air-cooled condenser of the outdoor unit has been closed.
- 2. Check that the power or control circuits are reliably connected. Fasten all the connecting terminals.
- 3. The power cables and the low voltage control cables are laid away from each other.

4. Check the phase sequence. The phase sequences of all three-phase devices have been adjusted consistent before delivery. During commissioning, you only need to ensure the phase sequence of a random three-phase device is correct. In step two of 4.2.2 Commissioning Procedures, if you run the fan by clicking on the fan contactor in the electric control box with a straight screwdriver, you can judge the phase sequence by observing the wind direction. If the phase sequence is wrong, exchange any two phases of the L line of the power supply.

# 4.2.2 Commissioning Procedures

- 1. Turn off the MCB of various parts. Turn on the isolation switches and control MCBs. Check the control voltage.
- 2. Click on the fan contactor with a screwdriver to start the fan and make sure the fan blowing direction is correct. Start the system and measure all the operation phase-currents of the fan.
- 3. Turn on the electric heating MCB and change the temperature setting to start the heater, or start the heater manually. Measure all the phase currents of the electric reheat.

To trigger the heater, you should:

Adjust the temperature setting to  $5^{\circ}$ C higher than the equipment room temperature. The control system should then trigger the heating demand, and the electric reheat starts to work. Then adjust the temperature setting to  $5^{\circ}$ C lower than the equipment room temperature. If the heater stops working, it means the heating function is normal. Then continue with the following procedures.

4. Turn on the humidifier MCB and change the humidity setting to start the humidifier, or start the humidifier manually. Measure all the phase currents of the humidifier. In addition, inject water manually to make sure the filling pipe and drainage conduit do not leak, and the drainage conduit is clear.

To trigger the humidifier, you should:

Adjust the humidity setting to 10% higher than the indoor Relative Humidity (RH). The control system should then trigger the humidifying demand, and the humidifier starts to work. If the humidifier stops working when the humidity setting is lower than the indoor RH, it means the humidifying function is normal.

### Note

After the test, restore the temperature and humidity settings to the defaults or the original settings.

5. Pump the cooling system vacuum to -30in.Hg (pumping time: >3hrs), and hold the state for 4hr. The pressure should not rise, and the sight glass appears green (to make sure the cooling system vacuum and dry, pump the cooling system repeatedly at least three times).

After checking the vacuum state of the cooling system, pump in proper amount of liquid refrigerant quickly before the power-on (usually pump until the pressures inside the refrigerant container equalizes with that in the cooling system). Connect the composite pressure gauge to the interface on the high/low pressure needle valve.

Connect the composite pressure gauge to the refrigerant cylinder. Note to exhaust the air inside the tube of the gauge.

1) Change the temperature setting to start cooling, or start cooling manually. Make sure the dehumidification and hot gas bypass valve is closed. Measure in real time all the phase currents of the compressor.

To start cooling (start the compressor), you should:

Change the temperature setting to  $5^{\circ}$ C lower than the indoor temperature. The control system should then trigger the cooling demand, and the compressor starts to work. After at least three minutes of cooling, change the temperature setting to  $5^{\circ}$ C higher than the indoor temperature. If the compressor stops working then, it means the cooling function is normal.

### Note

After the test, restore the temperature setting to the default or the original setting.

- 2) Check and confirm the working current of the condenser fan. Make sure the fan runs stably.
- 3) Start the compressor, and charge refrigerant gas (R22) or refrigerant liquid (R407C) slowly to the compressor inlet until the subcooling degree reaches 5K (or 8K ~ 10K) and the sight glass contains no air bulbs.

The condensing temperature should be kept at 45°C.

Keep charging and adjust the thermostatic expansion valve to  $5^{\circ}$ C  $\sim 8^{\circ}$ C superheat degree. The adjustment step of the valve should be smaller than 1/4 round, and the interval between two steps should be at least 15min.

Observe the compressor suction pipes and make sure there is no water condensing on the surface of the compressor and the pipes, so as to avoid the risk of slugging the compressor.

At the return of  $22^{\circ}/50\%$ , 16Bar ~ 17Bar condensing pressure, the compressor suction pressure should be above 5 Bar

At the return of  $24^{\circ}$ C/50%, 16Bar ~ 17Bar condensing pressure, he compressor suction pressure should be above 5.5Bar.

4) Check the dehumidification function

To trigger dehumidification, you should:

Change the humidify setting to 10% lower than the indoor RH. The control system should then trigger the call for dehumidification, the dehumidification solenoid valve switches on, and the dehumidification indicator Q3 on the control panel turns on. Then change the humidity setting higher than the indoor RH. If the dehumidification solenoid valve switches off, and the dehumidification indicator Q3 turns off, it means the dehumidification function is normal. Note that during the commissioning process, if the indoor temperature is 3°C higher than the temperature setting, the system may enter the forced cooling mode, and the dehumidification demand will not be responded.

### Note

After the test, restore the humidity setting to the default or the original setting.

### 4.2.3 Commissioning Complete Inspection

- 1. Check that all output functions are automatic.
- 2. Check that the temperature & humidity settings and control precisions are set reasonable.
- 3. Make sure all the other functions are set reasonable.

# **Chapter 5 Precision Air Conditioner Controller**

This chapter expounds the appearance, control button, indicator, control interface and menu structure of PACC11Z precision air conditioner controller (controller for short).

The controller adopts menu operation. It is used to monitor, display and operate the precision air conditioner (AC) to maintain the environment within the setting range. The display board of the controller adopts a 240 x128 LCD screen with blue back lighting for clear display of text and graphics.

# 5.1 Appearance

The controller is shown in Figure 5-1.



Figure 5-1 Controller appearance

# 5.2 Control Button

# 5.2.1 Function Description

The controller provides five control buttons (see Figure 5-1), including ON/OFF button, ESC button, UP button, ENTER button and DOWN button. Their detailed functions are listed in Table 5-1.

Button	Function descriptions
ON/OFF	Turn on or off the controller
ESC	Return to the previous menu. Abort parameter change. Press and hold the button to enter the help menu for listing the max., min. and default values and a brief description of the data field. Upon alarms, press the button to silence the audible alarm
UP	Move the cursor up or increase the parameter value. For a toggle selection: scroll through the options. For a multi-screen menu: scroll up the screen
ENTER	Enter the next level menu or validate the parameter setting value
DOWN	Move the cursor down or decrease the parameter value. For a toggle selection: scroll through the options. For a multi-screen menu: scroll down the screen
ENTER + UP	View the previous AC unit state (note that the UP button should be pressed second, but released first)
ENTER + DOWN	View the next AC unit state (note that the DOWN button should be pressed second, but released first)

Table 5-1 Control button functions

### 5.2.2 Operation Example

### **Example 1: Inputting the password to enter the Main Menu**

After the controller is powered on, you can enter the Main Menu through conducting the following operations on the main interface.

1. Press the ENTER button to enter the password interface.

- 2. Press the ENTER button to highlight the input data field in the password interface.
- 3. Press the UP or DOWN button to change the current number.
- 4. Press the ENTER button to confirm the password and enter the Main Menu interface.

### Note

If the input password is incorrect, press the ESC button to quit and input again.

### **Example 2: changing parameters**

Taking **High TEMP** on **Alarm Control** interface as an example, the procedures are as follows:

- 1. Press the UP or DOWN button to move the cursor on the Alarm Menu menu in the Main Menu interface.
- 2. Press the ENTER button to enter the Alarm Menu menu.
- 3. Press the UP or DOWN button to move the cursor on Alarm Control item in the Main Menu interface.
- 4. Press the ENTER button to enter the Alarm Control interface.
- 5. Press the UP or DOWN button to move the cursor on **High TEMP**.
- 6. Press the ENTER button to highlight the parameter field of High TEMP.
- 7. Press the UP or DOWN button to select the parameter.
- 8. After selecting, press the ENTER button to confirm. The parameter will take effect.
- 9. Press the ESC button to return to the previous menu interface.

### ☐ Note

After changing the parameter, if you do not press the ENTER button to validate the changed parameter, the change will be invalid.

# 5.3 Indicator

The controller provides two indicators: running indicator and alarm indicator (see Figure 5-1). Their detailed functions are described in Table 5-2.

Table 5-2 Function descriptions of indicators

Indicator	Color	Status	Function descriptions
Running indicator	Green	On	The controller is working normally
ixuming malcator	Oleen	Off	The controller is not working normally
Alarm indicator	Red	On	No alarm is generated
Alaim indicator	Neu	Blinking	An alarm is generated

# 5.4 Control Interface

The LCD screen displays the communication status after the controller is powered on. If the controller cannot communicate with its target interface board, the LCD screen will prompt **Communication Failure**. If the communication is successful, the screen will display an OFF interface or a MAIN interface, which depends on whether the AC unit is on or off.

### 5.4.1 OFF Interface

If the AC unit is turned off, after successful communication, the LCD screen will display the OFF interface, as shown in Figure 5-2. As for which OFF interface will be displayed, it depends on the off mode of the AC unit.



Figure 5-2 OFF Interface

12. Temperature graph within 1h

### 5.4.2 MAIN Interface

If the AC unit is turned on, after successful communication, the MAIN interface will appear on the LCD screen, as shown in Figure 5-3. If no control button is pressed within 2min, the controller will enter a screen-protection state (the back lighting is off) until any control button is pressed. In this interface, pressing the UP or DOWN button can regulate the contrast of the LCD screen. Pressing the UP button brightens the screen and pressing the DOWN button darkens it.

The MAIN interface provides the following information:

1. Date 2. Time 3. Weekly-date

4. Display board address 5. Interface board address 6. Actual temperature

7. Temperature setpoint 8. Actual humidity 9. Humidity setpoint

11. Humidity graph within 1h

10. Unit working icons (including fan, cooling, humidifying, dehumidifying, heating, general alarm, locking and on/off/standby state)

Display board Date Time weekly-date address Interface board address 2007/04 /13 09:00:00 FRI DÓ0 100 Actual temperature RT 24°C Temperature graph SP 24 °C -Temperature setpoint T=01 RT 51%rH Actual humidity Humidity graph Humidity setpoint SP 50%rH 22:15 ⊞ ₺

Figure 5-3 MAIN interface

Unit working icons

### Unit working icon

The MAIN interface provides three types of unit working icons, including dynamic running state icon, locking state icon and on/off/standby state icon. These icons inform the operators of the operation mode in which the AC unit is working. The icons and their definitions are listed in Table 5-3.

Mode Icon Definition Mode Icon Definition ╬ Fan running Locking state Ш Locking state icons 釆 щ Cooling state Unlocking state -∳: ⇗ Dynamic Heating state Standby state running state On/off/standby П \*\* Humidifying state Shut-down state icons state icons 办 × Dehumidifying state Running state ಠ General alarm

Table 5-3 Icon definitions

### Temperature graph

The temperature graph indicates the difference between the actual temperature and temperature setpoint. The number +15 (-15) on the right side of this graph is the difference between the max. (min.) temperature and the temperature setpoint. For example, the actual temperature of the point at +15 position is  $39^{\circ}$ C (=  $15^{\circ}$ C +  $24^{\circ}$ C).

# **Humidity graph**

The humidity graph indicates the difference between the actual humidity and the humidity setpoint. The number +15 (-15) on the right side of the humidity graph is the difference between the max. (min.) humidity and humidity setpoint. For example, the actual humidity of the point at -15 position is 35%RH = (50%RH + (-15%RH)).

### 5.4.3 Password Interface

Press the ENTER button in the MAIN interface and the password interface shown in Figure 5-4 will appear. Inputting the correct password and confirming it can enter the **Main Menu** interface. For details, refer to *5.2.2 Operation Example*.



Figure 5-4 Password interface

Three levels of passwords are provided for accessing the menu interface. The level of access for any menu item is indicated by the number enclosed in bracket at the end of each line, such as [1], [2] and [3]. The users, default passwords and the accessible menu levels of different passwords are listed in Table 5-4.

Password level User Initial password Level of access for menus

Level 1 General operator 0001 [1]

Level 2 Maintenance personnel [1], [2]

Level 3 Facotory technician [1], [2], [3]

Table 5-4 Password level

# 5.5 Menu Structure

The menus of the controller are constructed in a tree-like structure in which levels of submenus are accessed through the main menu. Some menus are password protected. Inputting different levels of password can access different levels of submenu.

### 5.5.1 Guide On Finding Menus

The menu structure of the controller is relatively complex. To find the required menu, you can use the guides in Table 5-5 or refer to *Appendix 4 Menu Structure Figure*.

Task Recommended title Inquire or set the menus relating to alarm Alarm Menu 5.5.3 Set temperature or humidity 5.5.4 Set Point Control Inquire the input status, output status and self-defined input 5.5.5 System Status status of the AC unit components Set the input and output status of the AC unit components 5.5.6 System Menu Set the time and date Set Time/Date 5.5.7 Inquire the temperature and humidity changes from 6h to 48h Graph Menu 5.5.8 Inquire the running times of the AC unit components or reset 5.5.9 Run Hours the running overtimes Inquire the on/off records of some important components, 5.5.10 On/Off Record including fan, compressor, humidifier and electrical heater If multi-units is used, inquire or set the teamwork mode, unit number, shandby number, cascade, rotation number, manual 5.5.11 Team Work cascade, cascade frequency, cascade time as well as inquiring the status of the units #00 ~ #15

Table 5-5 Guide on finding menus

### 5.5.2 Main Menu

The **Main Menu** includes eight submenus, displayed in two screens, as shown in Figure 5-5. For details, refer to Appendix5 *Alarm Control Menu Table*. For quick index of the menus, refer to *5.5.1Guide On Finding Menus*.

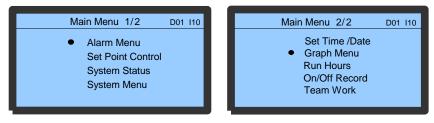


Figure 5-5 Main Menu interface

To select a submenu, press the UP or DOWN button to move the cursor to the required item. When the cursor is on the selected item, a small black dot will appear on the left side of the menu item. At this time, pressing the ENTER button can enter its submenu or set its parameter. Some menu items are settable and others are not. For detailed setting procedures, refer to 5.2.2 Operation Example. For the setting ranges of the settable menu items, refer to Appendix 6 Parameter Setting Table.

### Note

The menus with a black dot on the left side have submenus or their parameters can be set.

### 5.5.3 Alarm Menu

Select **Main Menu 1/2** -> **Alarm Menu** to enter the **Alarm Menu** menu. This menu haves five submenus, as shown in Figure 5-6.

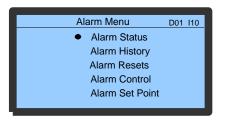


Figure 5-6 Alarm menu interface

### Alarm status

The **Alarm Status** menu is used to record the current active alarm status, including **Active Alarms** (total alarm number), **ALM** (alarm SN. + alarm type), **Time** (start time + end time), as shown in Figure 5-7.

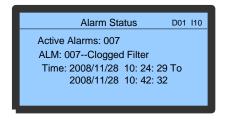


Figure 5-7 Alarm status interface

# □ Note

- 1. The alarm with the biggest SN. is the latest alarm.
- 2. When several alarms are generated, you can press the UP or DOWN button to scroll through the alarm status records.
- 3. The controller can store up to 100 alarm records. They will be cleared upon system power-off.

# **Alarm history**

The **Alarm History** menu is used to inquire the historical alarm records, including **Logged Alarms** (total alarm number), **ALM** (alarm SN. + alarm type), **Time** (start time + end time), as shown in Figure 5-8.

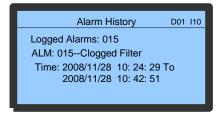


Figure 5-8 Alarm history interface

### Note

- 1. When several alarms are generated, you can press the UP or DOWN button to scroll through the historical alarm records.
- 2. The controller can store up to 200 historical alarm records. They are not cleared up system power-off.

### **Alarm resets**

The **Alarm Resets** menu is shown in Figure 5-9. This menu is used to clear some important alarm status. The menu items can be set to **YES** or **NO** (default). If the **Reset HP1 Alarm** menu item is set to **YES**, after HP1 alarm is generated, its corresponding record in the **Alarm Status** menu will be cleared.



Figure 5-9 Alarm resets interface

### Alarm control

The settings of the **Alarm Control** menu will not be lost when the power fails. You can browse and set all menu items. For detailed submenus, refer to *Appendix 5 Alarm Control Menu Table*. For detailed setting ranges of menu items, refer to *Appendix 6 Parameter Setting Table*.

The **Alarm Control** menu is displayed in 16 screens. Press the UP or DOWN button to select the required submenu item. Taking the first screen as an example, the menu interface is shown in Figure 5-10.

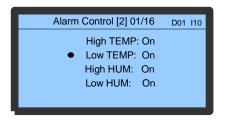


Figure 5-10 Alarm control interface

The menu items (other than **Customer Input**) can be set to **On**, **Event** or **Off**.

- On: when an alarm is generated, the Alarm Status menu will pop up with a buzzer beeping and general alarm output. You also can find alarm record in the Alarm Status and Alarm History menu.
- Event: when an alarm is generated, you can find alarm record in the Alarm Status and Alarm History menu. No any prompt exits.
- Off: when an alarm is generated, no record and prompt will appear.

The tenth screen is the **Customer Input** menu, used to set alarm control and normal status. Select a submenu and enter its interface, as shown in Figure 5-11. The **Alarm Control** items can be set to **On**, **Event** or **Off**. Their logic definitions are the same as others. The **Normal Status** items can be set to **Open** or **Closed**.

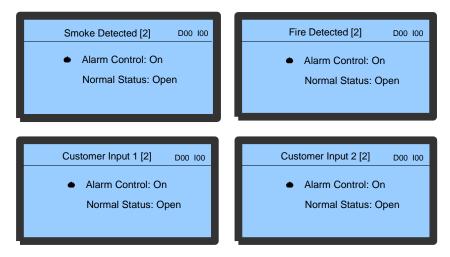


Figure 5-11 Customer input interface

### Alarm set point

The **Alarm Set Point** menu is shown in Figure 5-12. The settings of the **Alarm Set Point** menu will not be lost when the power fails. For detailed setting ranges of menu items, refer to *Appendix 6 Parameter Setting Table*.

### Note

It is not recommended to change the defaults. If the change is necessary, change them under the guidance of trained professions.

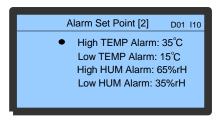


Figure 5-12 Alarm set point interface

### 5.5.4 Set Point Control

Select **Main Menu 1/2** -> **Set Point Control** in interface to enter the **Set Point Control** menu, as shown in Figure 5-13. The setpoints will not be lost when the power fails. The menu is used to set the current running temperature & humidity and their sensitivities of the AC unit. For detailed setting ranges, refer to *Appendix 6 Parameter Setting Table*.

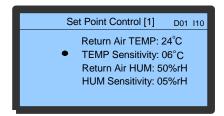


Figure 5-13 Set point control interface

# 5.5.5 System Status

Select **Main Menu 1/2** -> **System Status** to enter the **System Status** menu, as shown in Figure 5-14. You can inquire the output status, input status and power status or set the NTC menu items.

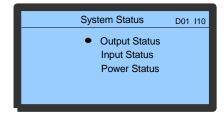


Figure 5-14 System status interface

### **Output status**

The Output Status menu is shown in Figure 5-15.

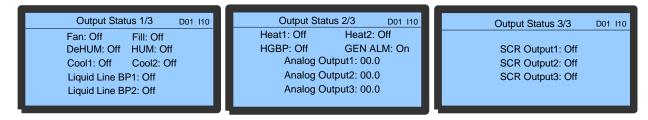


Figure 5-15 Output status interfaces

### Input status

The **Input Status** menu is displayed in six screens. Pressing the UP or DOWN button can select the required menu item. Taking the first screen as an example, the interface is shown in Figure 5-16. For detailed menu items, refer to *Appendix 4 Menu Structure*.

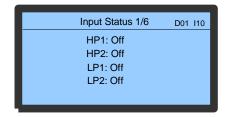


Figure 5-16 Input status interface

The menus (NTC0, NTC1, NTC2 and NTC3) in the sixth screen allow you to define the input status. The submenu interfaces are shown in Figure 5-17. For detailed setting ranges, refer to *Appendix 6 Parameter Setting Table*.

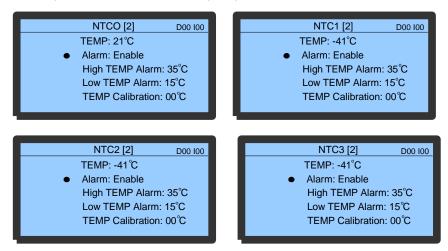


Figure 5-17 NTC interfaces

### **Power status**

The **Power Status** menu is shown in Figure 5-18. You can inquire the input power status of the unit listed in Figure 5-18

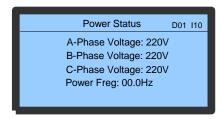


Figure 5-18 Power status interface

## 5.5.6 System Menu

Select **Main Menu 1/2** -> **System Menu** to enter the **System Menu** menu. This menu is displayed on two screens, as shown in Figure 5-19.

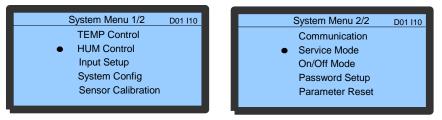


Figure 5-19 System menu interface

### **TEMP Control**

The TEMP Control menu is displayed on two screens, as shown in Figure 5-20.

Only factory technicians can access the latter seven menu items. For detailed setting ranges of the menu items, refer to *Appendix 6 Parameter Setting Table*.

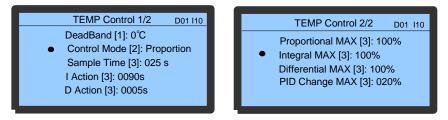


Figure 5-20 TEMP control interface

## **HUM** control

The **HUM Control** menu is displayed on two screens, as shown in Figure 5-21. Only factory technicians can access the menu. For detailed setting ranges of the menu items, refer to *Appendix 6 Parameter Setting Table*.

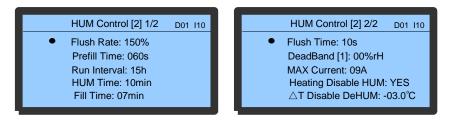


Figure 5-21 HUM control interface

### Input setup

The Input Setup menu is shown in Figure 5-19. Only factory technicians can access the menu.

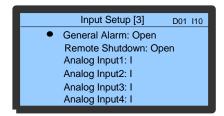


Figure 5-22 Input setup interface

# System config

The **System Config** menu is shown in Figure 5-23. For detailed setting ranges of the menu items, refer to *Appendix 6 Parameter Setting Table*.

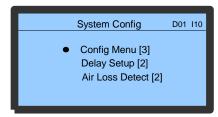


Figure 5-23 System config interface

### 1. Config menu

The Config Menu menu is shown in Figure 5-24. Only factory technicians can access the menu.

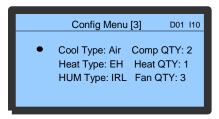


Figure 5-24 Config menu interface

## 2. Delay setup

The Config Menu menu is displayed on two screens, as shown in Figure 5-25.

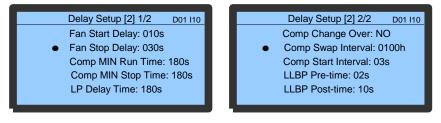


Figure 5-25 Delay setup interface

### 3. Air loss detect

The Air Loss Detect menu is shown in Figure 5-26.

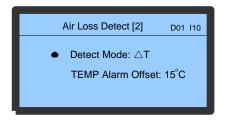


Figure 5-26 Air loss detect interface

### **Sensor calibration**

The Sensor Calibration menu is shown in Figure 5-27.

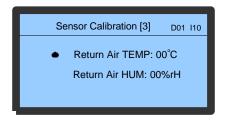


Figure 5-27 Sensor Calibration interface

### Communication

The **Communication** menu is shown in Figure 5-28. For detailed setting ranges of the menu items, refer to *Appendix 6 Parameter Setting Table*.

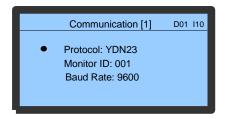


Figure 5-28 Communication interface

### Service mode

Select System Menu 2/2 -> Service Mode to enter the Service Mode menu, as shown in Figure 5-29.

The menu is used for the maintenance personnel to view whether the system is working normally.

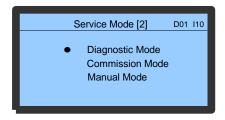


Figure 5-29 Service mode interface

The **Diagnostic Mode**, **Commission Mode** and **Manual Mode** menus have the same submenu. Taking **Diagnostic Mode** menu as an example, the menu interface is shown in Figure 5-30.

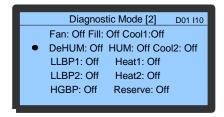


Figure 5-30 Diagnostic mode interface

### Note

- 1. Under the commission mode and manual mode, the LLBP1, LLBP2 and HGBP are off.
- 2. Under the commission mode and diagnostic mode, after you press the ESC button to exit the mode, the system will restore the normal control.
- 3. Under the manual mode, after you press the ESC button to exit the mode, all status can restore the normal control until the controller is restarted after powered off.

### On/Off mode

Select **System Menu 2/2 -> On/Off Mode** to enter the **On/Off Mode** menu, as shown in Figure 5-31. Only the factory technicians can access the menu.

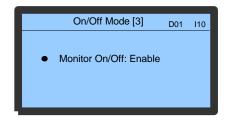


Figure 5-31 On/Off mode interface

### Password setup

The Password Setup menu is shown in Figure 5-32.

The operators with level 1 or 2 password can change the password through the menu. Press the ENTER button to validate the changed values, you can use the new password to access the menus. For detailed setting ranges of the menu items, refer to *Appendix 6 Parameter Setting Table*.



Figure 5-32 Password setup interface

### Parameter reset

The **Parameter Reset** interface is shown in Figure 5-33. For detailed setting ranges of the menu items, refer to *Appendix 6 Parameter Setting Table*.

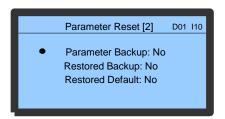


Figure 5-33 Parameter reset interface

### 5.5.7 Set Time/Date

Select Main Menu 2/2 -> Set Time/Data to enter the Set Time/Data menu, as shown in Figure 5-34.

You can change the current system data (Y/M/D) and time (H:M:S) through the menu. Press the ENTER button after changing and the changed system data and time will be displayed automatically on the interface.

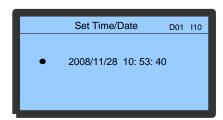


Figure 5-34 Set time/data interface

### 5.5.8 Graph Menu

Select **Main Menu 2/2** -> **Graph Menu** to enter the **Graph Menu** menu, as shown in Figure 5-35. Through the menu, you can inquire the return air temperature and humidity graphs, which reflect the temperature and humidity changes over a period of time in the past.

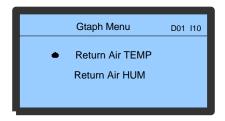


Figure 5-35 Graph menu interface

1. Select **Graph Menu** -> **Return Air TEMP** to enter the **Return Air TEMP** submenu, as shown in Figure 5-36. In the graph, current temperature is the origin, time is the horizontal axis and temperature is the vertical axis. The graph can display the temperature changes from 6h to 48h through zooming operation and controlling the cursor movement. Pressing the UP or DOWN button moves the cursor to the required zoom-control bar. Press the ENTER button to enter editing status and then press the UP or DOWN button to zoom the graph in or out.

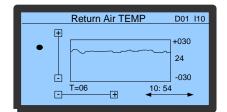


Figure 5-36 Return airTEMP graph interface

2. Select **Graph Menu** -> **Return Air HUM** to enter the **Return Air HUM** submenu, as shown in Figure 5-37. In the graph, current humidity is the origin, time is the horizontal axis and humidity is the vertical axis. The graph can display the humidity changes from 6h to 48h through zooming operation and controlling the cursor movement. Pressing the UP or DOWN button moves the cursor to the required zoom-control bar. Press the ENTER button to enter editing status and then press the UP or DOWN button to zoom the graph in or out.

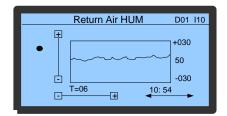


Figure 5-37 Return air HUM graph interface

### 5.5.9 Run Hours

Select **Main Menu 2/2** -> **Run Hours** to enter the **Run Hours** menu. The menu is displayed in two screens, as shown in Figure 5-38. You can inquire the accumulated running hours of some components, including fan, compressor, electrical heater and humidifier, and set the service interval through the menu (For its detailed setting ranges, refer to *Appendix 6 Parameter Setting Table*).

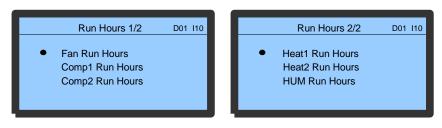


Figure 5-38 Run hours interface

The fan, comp1, comp2, heat1, heat2 and HUM run hours have the same submenus. Taking the **Fan Run Hours** menu for example, the submenu interface is shown in Figure 5-39. You can view the accumulated running hours of the fan.

If the value in **Operation Hours** exceeds that in **Service Interval**, the system will generate an alarm to inform the maintenance personnel with fan maintenance. After the fan is maintained, the **Operation Hours** will be cleared. After setting the **Hour Reset** to **YES**, the maintenance personnel can reset the **Service Interval**.



Figure 5-39 Fan run hours interface

### 5.5.10 On/Off Record

Select the **On/Off Record** in the **Main Menu 2/2** interface and press the ENTER button to enter the **On/Off Record** menu, as shown in Figure 5-40. Only factory technicians can access the menu.

This menu is used to record the on/off information of some important components, such as fan, compressor, electrical heater and humidifier. These records provide a base and reference to maintenance personnel for part maintenance.

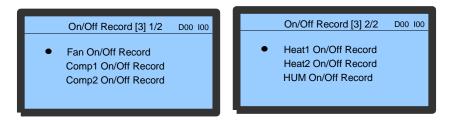


Figure 5-40 On/off record interface

The fan, comp1, comp2, heat1, heat2 and HUM have the same submenus. Taking the **Fan On/Off Record** menu for example, the submenu interface is shown in Figure 5-41. The menu items include **Records** (total record number), **No.** (record SN) and **Time** (fan on and off time).



Figure 5-41 Fan on/off record interface

### 5.5.11 Team Work

Select **Main Menu 2/2** -> **Team Work** to enter the **Team Work** menu. The menu is displayed in two screens, as shown in Figure 5-42. The second screen provides the working status of #00 ~ #15 units. For detailed setting ranges of the menu items, refer to *Appendix 6 Parameter Setting Table*.

The teamwork mode can be set to Single, 0, 1, 2 or 3, which are applicable to different cases, as follows:

- Single: Each unit operates independently without communication with each other.
- 0: Each unit operates independently. But the communication exits among them.
- 1: It is applicable to the case with an even temperature & humidity load.
- 2: It is applicable to the case with an uneven temperature & humidity load. Each unit independently computes the individual requirement.
- 3: It is applicable to the case with an uneven temperature & humidity load. The lead unit distributes the requirement for each unit.

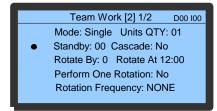




Figure 5-42 Team work interface

# 5.6 Help Menu

Press and hold the ESC button in any menu interface and the help interface will appear, as shown in Figure 5-43

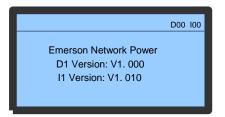


Figure 5-43 Help interface

# Chapter 6 System O&M

This chapter introduces the operation and maintenance of the Liebert\_DM 16kW air conditioner.

# 6.1 Operation and maintenance of indoor unit

# 6.1.1 Self-diagnosing Functions

As limited by the environmental conditions, certain components may remain idle for a long time, and there is no telling of whether they are faulty. However, upon urgent needs, such components may fail to meet the demand. Therefore it is necessary to check the system components regularly. The controller provides the function that enables you to turn on/off the components onsite manually so as to check their functionality. For the operation instruction, see 错误! 未找到引用源。错误! 未找到引用源。

### Note

- 1. During the operation of the Liebert\_DM 16kW system, lethal voltage may be present in the internal parts. It is a must to obey all the notes and warnings marked on the equipment or contained in this manual, otherwise injury or fatality may occur.
- 2. Only qualified maintenance and repairing personnel can operate and process the system.

### 6.1.2 Electric Control Part

### Maintenance of electric part

Carry out visual inspection and handling over the electrical connection by referring to the following items.

- 1. Overall electrical insulation test: find out the unqualified contacts and handle them. Note to disconnect the fuses or MCBs of the control part during the test lest the high voltage should damage the control components.
- 2. Carry out detection over the contactors before the power-on, make sure the contactors can act freely without obstruction.
- 3. Clean the electric and control components of dust with brush or dry compressed air.
- 4. Check the closing of contactors for arcs or signs of burning. Replace the contactor if necessary.
- 5. Fasten all the electric connection terminals.
- 6. Check that the sockets and plugs are in good condition. Replace those loosened ones.

### Maintenance of control system

Carry out visual inspection, simple function test and handling over the control parts by referring to the following items.

- 1. Visually inspect the power transformers and isolation transformers and test the output voltage (of the indoor unit & outdoor condensers).
- 2. Check that there is no signs of aging on the control interface board, display control board, sensor board and fuse board.
- 3. Clean the electric control components and control board of dust and dirt with brush and electronic dust removing agent.
- 4. Check and fasten the I/O ports at the control interface board, including the connection between display control board and control interface board, as well as between the temperature/humidity sensor board and the interface board.
- 5. Check the connection between the user terminals (70, 71, 70A, 71A, 37, 38, 77, 78) and the control interface board.
- 6. Check the output connection between the control interface board and various components, including various contactors, solenoid valves for liquid pipes and bypass solenoid valves (HG bypass, liquid bypass). The input connection between control interface board and various components, including fan overload protector, HP/LP switches, heating over-temperature protection switch, humidifier dry-burn protection switch, filter clogging switch and filter pressure difference switch. In particular, check the connection parts such as HP/LP switches and solenoid valves, and replace the component if it is found loosened or in poor connection.
- 7. Replace the electric components that are detected faulty, such as faulty control fuses (or MCBs) and control boards.

- 8. Check the specification and aging situation of the control cable and power cable between the indoor unit and the condenser, and replace the cable when necessary.
- 9. Use temperature/humidity measuring meter with high precision to proof-read and calibrate the temperature/humidity sensor. Note to set the humidity control mode to RH control during the process of calibration.
- 10. Check the following external sensors.
  - 1) Smoke detector (optional)

The power supply of the smoke detector is located at the bottom (or top) of the upflow (or downflow) unit. It incessantly samples the air, analyzes the samples and makes judgment. It requires no calibration.

2) Water leak detector

The water leak detector has a dry contactor. The contactor will close when the detector probes detect water or other conductive liquid.

The detector should be placed away from any water pool or drainage trench on the floor,  $2m \sim 2.5m$  away from the machine. Do not place it directly under the machine. The recommended location for the water leak detector is shown in Figure 6-1.

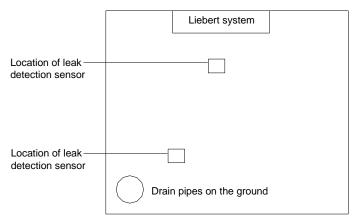


Figure 6-1 Recommended location for the water leak detector

# ■ Note

- 1. Before connecting any mechanical parts or cables, make sure the power supply of the control unit has been disconnected.
- 2. Do not use the water leak detector adjacent to flammable liquid or use it to detect flammable liquid.
- 11. Adjust the set points. Check the auto-flush control logic and HG bypass logic of water pan of the infrared humidifier and the action of the functional parts according to control logic.
- 12. Simulate the fault scenario to check the work state of protection devices including high/low voltage alarm, high/low temperature alarm, high/low water level alarm and over-temperature protection device.

### 6.1.3 Dust Filter

To ensure efficient operation, the dust filter must be checked once a month, and be replaced as required. The filter clogging switch and pressure difference switch are located as shown in Figure 6-2.

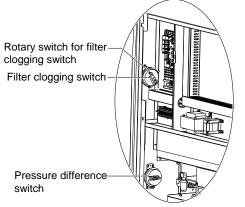


Figure 6-2 Filter clogging switch and pressure difference switch

Power off before replacing the filter. You need to adjust the setting point of the filter clogging switch if the new filter is of a different model. The filter clogging switch is located in the electric control box. It samples the air pressures before and behind the filter through a black hose, and decides the output after comparing the two values.

To adjust the setting point of the filter clogging switch, you should:

- 1. After replacing the filter, restore and seal all the panels, so that the alarm point can be found precisely.
- 2. Keep the fan running, and rotate the rotary switch of the filter clogging switch counter clockwise until the filter alarm is triggered.
- 3. Rotate the rotary switch clockwise for 2.5 rounds, or rotate it according to the new filter's model.

### Note

- 1. Set the setting point properly. Otherwise, the filter alarm may be triggered too frequently; or, in the opposite case, the dust accumulation on the filter could not trigger the alarm, endangering the system operation due to deteriorated ventilation.
- 2. If you are unsure about the setting point, consult with Emerson before using a filter of a different model to replace the old one.

### 6.1.4 Fan Kit

The fan components that require regular checking include belt, motor bracket, fan bearing and blades.

The fan and the installation board are designed in consistency. The belt tension is regulated automatically under the force of gravity, so as to reduce the fan vibration and protect the belt. If you need more details, please contact the manufacturer.

### **Fan Bearing And Blades**

Check the fan regularly to make sure the bearing is firmly fixed. Rotate the blades and make sure that they do not scratch the wall of the air duct. Because the bearing is permanently sealed and self-lubricated, check for signs of wearing when adjusting the belt. Roll the belt and observe the motion of the fan bearing. If any abnormal displacement is observed, replace the bearing.

#### Belt

Measure the belt tension with a tension meter. You can also press down the belt at the middle point between the two pulleys. The displacement should be  $0.5^{\circ} \sim 1^{\circ}$ .

If the belt is found worn out or distorted, replace it with a new belt. The new belt should be of the same model as the old one.

# Motor

To replace the failed motor, you need to be very careful, especially with the upflow unit. Use a dedicated fixture to hold the motor before removing the fixing bolts at the bottom of the motor.

# 6.1.5 Infrared Humidifier

During the normal operation of the humidifier, sediment will accumulate on the water pan. To ensure efficient operation of the humidifier, you need to clean the sediment regularly. However, the cleansing cycle varies because the water is different in different regions. It is recommended to check, and cleanse (when necessary) the water pan, once a month. Remove the water level regulator to drain the water pan. Disconnect the drainage pipe, remove the dry-burning protection switch of the water pan, remove the fixing screws at the two ends of the pan, and pull out the water pan. Cleanse the water pan with water and hard brush, and restore the water pan by reversing the preceding procedures.

### Note

Before removing the water pan, make sure that the power has been cut off, and the water in the water pan is not too hot.

The autoflush function of the humidifier can prolong the cleansing cycle. However, timed check and maintenance are indispensable.

### Replacing the lamps of the humidifier

The lamp of the infrared humidifier is shown in Figure 6-3. Follow the procedures below to replace it.

- 1. Cut off the main isolation power switch.
- 2. Unplug all the control lines of the humidifier and cut off the cable ties that binds the humidifier power cables. In the single-door system, the plugs of the humidifier are sealed in the niche above the lamp, and you need to open the cover

plate in front of the humidifier before you can reach the plugs. The plugs of the double-door and triple-door systems are located to the left of the humidifier and are accessible directly.

- 3. After draining the water in the water pan, remove the drainage pipe, remove the fixing screws on both sides of the humidifier, and then pull out the humidifier.
- 4. Open the cover plate (for single-door system, this cover plate has been opened in step two) to reveal the ceramic socket. Use the multimeter to locate the burned lamp.
- 5. Remove the humidifier water pan.
- 6. Remove the brackets in the middle that support the lamps.

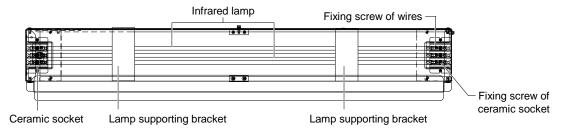


Figure 6-3 Lamps of infrared humidifier

- 7. Remove the screws that fix the cables of the lamp to be replaced from the ceramic sockets (note to hold the lamp with hand).
- 8. Pull down the lamp.
- 9. Install a new lamp.

#### ☐ Note

Do not touch the quartz lamp with bare hands! Greasy sediment and finger prints can seriously shorten the life span of quartz lamps. Therefore, put on clean cotton gloves during the operation.

10. Restore the humidifier by reversing steps  $3 \sim 8$ .

### Autoflush system of the infrared humidifier

# □ Note

The normal operation of the autoflush system, the humidifier demands a water source with minimum water flow of 1gpm (0.063 l/s) and minimum pressure of 20 psig (138kPa).

### Operation of the autoflush

The autoflush control program is an integral part of the infrared humidifier system. The program automatically controls a water makeup valve to maintain the proper water level in the humidifier pan during operation. When a call for humidification exists, the program performs a series of checks.

The first check is to see how long the infrared humidifier has been off. If the off time is equal to or greater than the programmed value (factory default is 15hr), it is assumed that the pan is dry and a program called pre-fill is initiated to add water to the pan. During the pre-fill operation the infrared lamps are inactive. The pre-fill time is programmable with an adjustable range of 1 ~ 120s for either pan size. The factory default for a large pan is 60s and for a small pan is 30s.

If the off time is less than 15hr (or user programmed value) the pre-fill program is bypassed and the infrared lamps and water valve are activated at the same time to fill the pan to the proper water level and initiate humidification.

During normal infrared humidification operation the water makeup valve is periodically closed (no pan fill) and opened (pan fill) based on a timing sequence to allow for the evaporation of water from the pan.

With the humidifier water flush rate set at the factory default value of 150% the water makeup valve will open for 7min of till time with an off time of 45s between fill cycles for a small pan. For a large pan water makeup valve will open for 10min of fill time with an off time of 80s between fill cycles. You can modify the percentage from 110% to a maximum of 500% in 1% increments. See Figure 6-4 for humidification control logic.

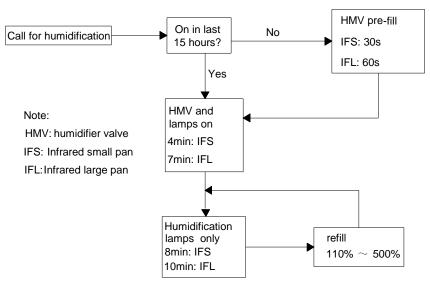


Figure 6-4 Humidification control logic

### 6.1.6 Electric Reheat

Check the rust on the electric reheat. If necessary, clean the dust with wire brush, or replace the heater.

The electric reheat is classified into upflow heater and downflow heater, as shown in Figure 6-5. Three temperature switches are in series connection within the internal control circuit of the heater, including two auto-reset switches and one manual reset switch. When the heater does not respond to the heating demand, check that the manual reset switch is on.

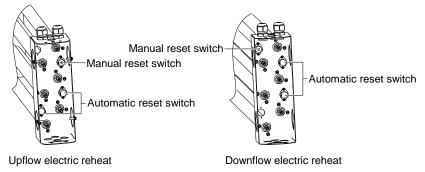


Figure 6-5 Upflow electric reheat and downflow electric reheat

### 6.1.7 Cooling System

Check the cooling system components once a month to make sure that the system function is normal and there are no signs of wearing. Because the failure or damage of components is usually accompanied by corresponding faults, regular checking is a major means to prevent most system faults. The refrigerant pipes must be supported by properly set brackets, and be laid away from the ceiling, floor or anywhere that vibrates. Check the refrigerant pipes once every six months to make sure that they are not worn out, and the fixing brackets are not loosened.

Each system has a sight glass to facilitate the observation of refrigerant flow and the system moisture content. When the system moisture content is too high, the sight glass turns from green to yellow.

When the cooling system is faulty, you can locate the fault by referring to certain parameters of system operation.

### **Suction Pressure**

The compressor may stop when the suction pressure drops below the setting of the low-pressure switch. On the other hand, too high suction pressure will undermine the cooling effect the refrigerant does to the compressor motor, leading to the damage of the compressor. The minimum (pressure switch action point) and the maximum (allowed by the system operation) suction pressure are listed in Table 6-1.

Table 6-1 Suction pressure

System	Min. pressure kPa (PSIG) R-22	Max. pressure kPa (PSIG) R-22		
Air-cooled (stepless fan speed controller)	138 (20)	620 (90)		
Water-cooled	138 (20)	620 (90)		
Note:				
The maximum operation LP of single system HG bypass should be lower than 700kPa				

#### **Exhaust Pressure**

The exhaust pressure may change with the load or the condenser efficiency. When the exhaust pressure rises to the setting of the pressure switch, the high pressure switch will act to stop the compressor. See Table 6-2 for details.

Table 6-2 Exhaust pressure

S	System design	KPa (PSIG)	System design	KPa (PSIG)
Air-cooled		1750 (251)	Maximum pressure	2275 (330)
Water-cooled	Water below 65°F ~ 75°F	1400 (203)	High pressure switch action	2760 (400)
vvaici cooled	Water at 85°F	1450 (210)	point	2700 (400)

### **Suction Superheat Degree**

The Thermal Expansion Valve (TXV) can regulate the suction superheat degree. Follow the procedures below to determine the system suction superheat degree.

- 1. Measure the temperature of the suction pipe at the TXV thermo bulb.
- 2. Sample the compressor suction pressure at the needle valve of the suction pipe.
- 3. Evaluate the pressure difference between the two locations: thermo bulb and needle valve of the suction pipe.
- 4. Add the sum of the preceding two pressures with the standard local air pressure to find out the saturation temperature corresponding to the saturation pressure.
- 5. The difference between the suction temperature at the thermo bulb and the saturation temperature is the suction superheat degree.

The suction superheat degree is critical to the compressor lifespan. If the compressor runs with little or no suction superheat degree for a long time, slugging may occur to the compressor, crashing the scroll plate of the scroll compressor.

# **Expansion Valve**

The auto-regulation of the expansion valve guarantees sufficient refrigerant for the evaporator in order to meet the needs of the load. The superheat degree is an indicator of the operation state of expansion valve. If the refrigerant to the evaporator is insufficient, the superheat degree will be high; and if the refrigerant to the evaporator is too much, the superheat degree will be low. The proper superheat degree is  $5.6^{\circ}$ C  $\sim$ 8.3°C.

Follow the procedures below to regulate the superheat degree setting.

- 1. Unscrew the bonnet at the bottom of the expansion valve.
- 2. Rotate the rotary switch counter clockwise to reduce the superheat degree.
- 3. Rotate the rotary switch clockwise to raise the superheat degree.

### Note

- 1. Before delivery, the refrigerant of water-cooled unit has been charged, and the expansion valve has been adjusted. If you need to adjust the expansion valve, please contact Emerson.
- 2. Every time you rotate the rotary switch, do not rotate it for more than one round, and it may take up to 30mins to reach a new balance.

### 6.1.8 Replacing The Compressor

## Warning

No direct contact between the refrigerant or lubricant and the skin when replacing the compressor, or serious burning or frostbite may occur. Put on gloves with long sleeves when processing polluted parts.

The Liebert\_DM 16kW system uses the highly reliable Copeland scroll compressor. If handled properly, the failure rate is extremely low.

It is rare for the motor of the compressor to get burned due to short circuit. In the few cases when the motor does get burned, the cause is usually mechanical or due to poor lubrication, in other words, due to over-temperature.

If the causes that lead to the compressor failure could be discovered and corrected in time, most failures are avoidable. The maintenance personnel should check the operation situation periodically and take necessary measures to ensure the system normal operation. This practice is both easy and cost saving, when you compare it with replacing the compressor upon faults that result from negligence.

When diagnosing the compressor, check the operation situation of all the electric parts of the compressor.

- 1. Check all the fuses and circuit breakers.
- 2. Check the operation of HP and LP switches.
- 3. When the compressor is faulty, find out the nature of the cause: is it an electrical fault or a mechanical fault?

#### For mechanical faults

Upon a mechanical fault, there is no burned smell. You should try spinning the motor. If the fault is proved to be mechanical, the compressor has to be replaced. If the motor is burned, you should remove the fault that leads to the burning of the motor and clean the system. It must be pointed out that the compressor motor is usually burned because the system is not cleaned properly.

#### For electric faults

You can tell an electric fault by the unpleasant smell. If serious burning occurred, the lubricant will appear black and become acid. When electric fault occurs and the compressor motor is entirely burned, the system must be cleaned to remove the acid material from the system and to avoid such faults in the future.

# □ Note

The damage to the compressor components due to improper way of cleaning is classified in the warranty agreement as improper usage of the product, thus is not covered by the warranty.

When the compressor is entirely burned, you need to replace the filter drier together with the compressor. In addition, check the expansion valve. If the valve is faulty, replace it too. Before the replacement, you must clean the system. If you are unsure about the cleaning method, please consult with Emerson service personnel.

### Compressor replacing procedures

- 1. Cut off the power supply.
- 2. Connect the LP and HP tubes of the pressure gauge to the needle valves of the suction and exhaustion pipes respectively to recycle the refrigerant.

### ☐ Note

The refrigerant must be recycled or disposed in accordance with the local regulations. Discharging the refrigerant into the air is harmful to the environment and illegal.

- 3. Disconnect all the electric connection to the compressor.
- 4. Disconnect the Rotalocks from the exhaust and suction openings on the compressor.
- 5. Remove the faulty compressor.
- 6. If the compressor has been entirely burned, you need to clean the pipes of the cooling system and replace the filter drier.

### Note

Do not remove the rubber covers from the suction opening and exhaust opening of the new compressor too early. The time that the openings are exposed to the air should not exceed 15mins so as to prevent the compressor refrigeration oil from absorbing water and bringing the water into the system.

- 7. Install the new compressor, and connect the pipes and electric cables.
- 8. Pump the system vacuum and add refrigerant in accordance with the commissioning regulations.
- 9. Power on the system by following the ordinary startup commissioning procedures and check the system operation parameters. Observe the refrigerant state through the sight glass, and determine the amount of refrigerant to be added by considering the system pressure and temperature until the system enters normal operation.

# 6.2 Operation and maintenance of outdoor unit

This chapter introduces the maintenance and troubleshooting of the condenser. Users should check the condenser regularly and solve the problems in time.

#### Note

- 1. The maintenance of the condenser must be done by technicians.
- 2. Except for the commissioning items that must be carried out with power on, during maintenance, the power of the indoor unit and the air switch of the condenser must be cut off.

### 6.2.1 Maintenance

### Refrigeration system

- 1. Check that the refrigeration pipes are firmly fixed. The refrigeration pipes shall not shake with the vibration of wall, earth or equipment frame. Otherwise reinforce the refrigeration pipes with fastening objects.
- 2. Check that there is no oil on the accessories of all refrigeration pipes, and make sure that the pipes do not leak.

### Heat exchanger

- 1. Clean the fin of heat exchanger regularly.
- 2. Clean the fin of heat exchanger with compressed air or fin detergent (weakly alkaline) if the condenser air flow is blocked. The direction of inverse air flow is good when the compressed air is used.
- 3. Check for damaged fins and maintain them in time.
- 4. Avoid snow accumulation around the condenser in winter.

### Fan

Check whether the fan runs normally, check it for problems such as abnormal noise, vibration and bearing failure.

### Fan speed controller

Check whether the fan speed controller board operates normally. If not, replace it as illustrated in the following paragraph.

### Note

Note that the position of bolt installation holes on the fan speed controller could be different on the actual product.

The fan speed controller is inside the electrical control box. Remove the cover plate of electrical control box before removing the fan speed controller board. Except for the seven bolts in Figure 6-6, other bolts are prohibited to be removed. The bolt 1 and bolt 2, which are used to fix the heat sink on the fan speed controller board, must be fastened firstly. The heat sink must cling to the floor of the electrical control box. After installing the heat sink, use the other five bolts to fix the fan speed controller board.

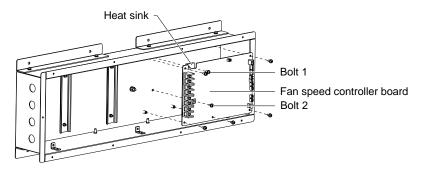


Figure 6-6 Removing the fan speed controller board

# 6.2.2 Troubleshooting

See Table 6-3 for alarm troubleshooting.

Table 6-3 Table of alarm troubleshooting

_	,	rable 0.3 Table of alarm trouk	
Alarm number ID	Alarm name	Cause	Troubleshooting
Phase loss		One phase or two phase of three-phase voltage is lost	Measure that the three-phase voltage is correct
A00	alarm	2. The input connection is reversed	2. Check the input order of wire
	alaiiii	3. The fan speed controller board has	3. Replace the fan speed controller board and compare
		hardware fault	the result of two boards
	SCR over	The fan cannot run normally	Check that the fan runs normally
A01	temperature	2. The fan speed controller board has	2. Replace the fan speed controller board and compare
	temperature	hardware fault	the result of two boards
		The fan cannot run normally	Check that the fan runs normally
	Fan 1 over	2. The AC contactor supplying power	2. Check the wiring of AC contactor; detect the auxiliary
A02, A03	temperature,	for fan has fault or its wire cuts off	contact state of AC contactor
A02, A03	Fan 2 over temperature	Fan speed controller board has hardware fault (the detecting circuit or SCR power supplying circuit has fault)	Replace the fan speed controller board and compare the result of two boards
		The pressure sensor is not installed or its terminal connection is poor	Check the wiring of pressure sensor
A04	Pressure sensor	Jumper caps are not used at shorting terminals J17 and J18 of current pressure sensor	Install the jumper cap when the current pressure sensor is configured
	failure	3. The pressure sensor failed	3. Replace the pressure sensor and compare the result of two boards
		The fan speed controller board has hardware fault	4. Replace the fan speed controller board and compare the result of two boards
A05	EEPROM read fault	The fan speed controller board has hardware fault	Replace the fan speed controller board and compare the result of two boards
A06	SCR temperature	The SCR temperature sensor is not installed or its terminal connection is poor	Check the wiring of SCR temperature sensors (J8 SCRTemp, see Figure 3-1 for whose position )
,,,,,	sensor	2. The SCR temperature sensor failed	Replace the SCR temperature sensor and compare
	failure	The fan speed controller has hardware fault	3. Replace the fan speed controller board and compare the result of two boards
A07	Abnormal frequency	The frequency of power supply voltage is wrong     The fan speed controller has hardware fault	Replace the fan speed controller board and compare the result of two boards

# **Chapter 7 Troubleshooting**

This chapter introduces the troubleshooting. You can read this part by referring to the part concerning the alarms.

# Caution

- 1. Certain circuits carry lethal voltages. Only professional technicians are allowed to maintain the machine.
- 2. Extra care should be taken when troubleshooting online.

# Note

If jumpers are used for troubleshooting, remember to remove the jumpers after the troubleshooting, or the connected jumpers may bypass certain control function and become a potential risk to the equipment.

Table 7-1 Fan fault removal

Symptom	Possible causes	Handling method
	No main power supply	Check the rated voltage at L1, L2 and L3
	Circuit breaker tripped or	Check the fuse and circuit breaker of the main fan unit
	fuse blown	Check the luse and check breaker of the main fail drift
	Overload, or MCB tripped	Reset manually, and check the average current
	Contactor does not close	Check the voltage between P36-3 and E1. If there is a 24Vac, while the
	Contactor does not close	contactor does not close, the contactor is faulty. Replace the contactor
Fan does not	Control board faulty	Check the voltage between P36-3 and E1. If there is no 24Vac, the control board
start	Control board faulty	is faulty. Check the state of the green indicator beside Q5 on the control panel
		Check the voltage between P36-3 and E1. If there is no 24Vac, and the green
	Fuse board faulty	indicator beside Q5 is off, check the indicator DS4 beside fuse F4 on the fuse
		board, or take down the F4 fuse tube to see whether or not it has blown
	Air flow lose switch alarm	Check whether the belt is loose or the fan has faulty
	(action)	Check whether the pertis 100se of the fail has faulty
	Fan failure	Replace the fan

Table 7-2 Troubleshooting of compressor and cooling system

Symptom	Possible causes	Handling method
C	Power not on (shutdown)	Check the main power switch, fuse or circuit breaker and the connecting cable
Compressor does not start	Power overloaded and MCB tripped	Manual reset and check the average current
not start	Circuit connection loosened	Fasten the connections
	Compressor coils shorted	Check the motor and replace it if defects are found
Compressor does	No demand for cooling	Check the controller state
not start, contactor does not close	High voltage switch acted	Check the high voltage switch
Contactor closed, but compressor	Fuse blown or circuit breaker disconnected	Check the fuse, circuit breaker and the contactor, and measure the circuit voltage
does not start	Compressor internal circuit breaker open	Check the compressor coils. If the coils are open, they will reset automatically after they cooled down
Compressor stops after running for 5mins (1min ~ 5mins settable). Contactor open	Refrigerant leaked, the LP switch does not close	Check the suction pressure
	Condenser clogged (air-cooled) or temperature of input water too high (water-cooled)	Clean the condenser (air-cooled) Check the cooling water system
High exhaust pressure	Condenser system does not start	Check the operation procedures
prossure	Too much frigerant	Check whether or not the subcooling degree is too high
	Water flow regulator improperly set (water-cooled)	Adjust the water flow regulator

Symptom	Possible causes	Handling method
	Water flow too big or temperature of input	Adjust the water flow regulator
	water too low (water-cooled)	Check the cooling water system
Low exhaust	Refrigerant leaked	Locate the leakage point, repair it and add refrigerant
pressure	Fan speed controller of outdoor unit is faulty, while the output voltage remains 100%, regardless of the change of condensing pressure (air-cooled)	If the fan speed controller is found faulty, replace it
The suction and exhaust pressures do not change after startup	Compressor reversed or compressor internal air tightness failed	If compressor reversed, exchange any two L lines of the compressor. If the compressor internal air tightness failed, replace the compressor
	Insufficient refrigerant in the system	Check for leaks. Seal the leaking point and add refrigerant
	Air filter too dirty	Replace the air filter
	Filter drier clogged	Replace the filter drier
Low suction pressure or liquid	Improper superheating degree	Regulate by strictly following the adjusting procedures of the thermal expansion valve
returned	Sensor of the expansion valve faulty	Replace the expansion valve
	Improper air flow distribution	Check the air supply and return system
	Low condensing pressure	Check for condenser fault
	Belt slipped	Check the belt and make necessary adjustment
Compressor too	Liquid returned	Refer to the handling methods of "Low suction pressure or liquid returned"
noisy	Bearing worn out due to insufficient lubricant	Add lubricant
	Fixture of compressor or pipes loosened	Fasten the fixture
Compressor over-temperature	Too high compression ratio	Check the settings of the HP switch and LP switch, and make sure the condenser is not clogged Check that the fans of the evaporator and condenser are normal
	Suction temperature too high	Regulate the expansion valve or add proper amount of refrigerant

Table 7-3 Troubleshooting of dehumidification system

Symptom	Possible causes	Handling method
	No dehumidification demand from the control system	Check the control system
	Compressor contactor does not close	Refer to the compressor related Table 7-2
Dehumidification ineffective	Compressor does not start, fuse blown or circuit breaker tripped	Refer to the compressor related Table 7-2 Or check the fuse, or the circuit breaker and the contacts, and check the line voltage
	Hot gas bypass valve not closed (single	Check the control circuit related to the hot gas bypass
	compressor system)	valve

Table 7-4 Troubleshooting of infrared humidifier

Symptom	Possible causes	Handling method
		Check the water supply
	No water in the	Check the water supply solenoid valve
	water pan	Check the state of the high water-level switch / water-level regulating valve
		Check that the water supply pipe is not clogged
	No humidification	Check the state of the controller
Humidiifcation	demand	Check the state of the controller
ineffective		Check the contactor, and check the circuit voltage of the fuse or circuit breaker
moncouve	The humidification	Check the opened safety devices of the humidifier: water pan over-temperature
	contact does not	protection switch and lamp over-temperature protection switch. Use a jumper to
	close	shot terminals P35-6 and P35-5. If the contactor closes, replace the
		series-connected safety device, and remove the jumper
	Humidifier lamp	Replace the lamp
	burned	replace the famp

Table 7-5 Troubleshooting of heating system

Symptom	Possible causes	Handling method
Heating system does not	No heating demand	Check the controller
start, the contactor does not close	Safety device of the heating system is open	In the case of two-level heating, check terminals P34-6 and P34-7. If the heating system then starts to work, it means the safety device is open. Remove the jumper and replace the safety device
Contactor closes, but heating is ineffective	Heater burned	Cut off the power supply and measure the resistance of the heater with an Ohm meter

Unit model: Filters:	Unit SN:
Filters:	
	5. The refrigerant pipes are properly supported
1. Check for clogging or damage	
2. Check the filter clogging switch	Refrigeration cycling system
3. Clean the filter	1. Check the suction pressure
	2. Check the discharge pressure
Fan	3. Check the refrigerant pipes
1. Fan blades are not distorted	4. Check the moisture content (through the
2. The bearings are not worn out	sight glass)
3. The belt tension and condition	5. Check the HG bypass valve
	6. Check the thermal expansion valve
Compressor	7. Check the liquid line bypass valve
1. Check for leakage	(water-cooled system)
2. Listen to the operation sound, observe the	
operation vibration	Heating system
•	1. Check the re-heater operation
Air-cooled condenser (if used)	2. Check the erosion situation of the
1. Check the fins cleanness	components
2. The fan base should be firm	
3. The fan vibration absorber is not deteriorated	Infrared humidifier
or damaged	1. Check clogging of the drain pipes
4. The SPD board should be effective (in the	2. Check the lamps of the humidifier
storming seasons, the SPD board should be check	3. Check the mineral sediments on the water
once a week)	pan
Signature: Note: copy this table for filing.	

Affiliated table 2: maintenance table (six-month)

Inspection date:	Prepared by:
Unit model:	Unit SN:
	<del></del>
Filters	3. Check for leakage
1. Check for clogging or damage	
2. Check the filter clogging switch	Refrigeration cycling system
3. Clean the filter	1. Check the suction pressure and suction
	superheat degree
Fan	2. Check the discharge pressure and
1. Fan blades are not distorted	condensing subcooling degree
2. The bearings are not worn out	3. Check the refrigerant pipes
3. The belt tension and condition	4. Check the moisture content (through the
4. Check and fasten the circuit connections	sight glass)
<del></del>	5. Check the HG bypass valve
Compressor	6 Check the thermal expansion valve
1. Check for leakage	7. Check the liquid line bypass valve
2. Listen to the operation sound, observe the	(water-cooled system)
operation vibration	8. Check whether or not refrigerant should be
3. Check and fasten the circuit connections	added through the sight glass
Air-cooled condenser (if used)	Heating system
1. Check the fins cleanness	1. Check the re-heater operation
2. The fan base should be firm	2. Check the erosion situation of the
3. The fan vibration absorber is not deteriorated	components
or damaged	3. Check and fasten the circuit connections
4. The SPD board should be effective (in the	
storming seasons, the SPD board should be check	Infrared humidifier
once a week)	1. Check clogging of the drain pipes
5. Check the voltage regulating function of the	2. Check the lamps of the humidifier
rotation speed controller	3. Check the mineral sediments on the water
6. The temperature switch is set at the required	pan
position	4. Check and fasten the circuit connections
7. The refrigerant pipes are properly supported	
8. Check and fasten the circuit connections	Electric control part
	1. Check the fuses and MCB
Water-cooled condenser (if used)	2. Check and fasten the circuit connections
1. Clean the water pipe system	3. Check the control program
2. Check the water flow regulating valve	4. Check the contactor action
Signature	
Note: copy this table for filing.	

# **Appendix 1 SiteMonitor Software Introduction**

SiteMonitor monitoring software is developed by Emerson Network Power Co., Ltd. (Emerson for short) to monitor the UPS, AC (CM+, DM, Deluxe), and LTS series static transfer system (STS) developed by Emerson; it can also perform centralized monitoring and handling over various ambient signals, such as temperature, humidity, smoke and fog, water logging, infrared, through optional equipment, like ambient signal adapter.

SiteMonitor can run on Windows, Linux, Solaris, AIX and HP-UX operating systems. It is accessed with a Web browser. You may use any computer over the network to log in SiteMonitor to conduct equipment monitoring and maintenance management. The software interface is shown in Figure 2.

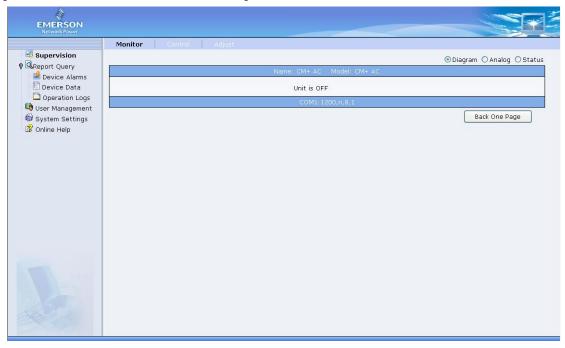


Figure 1 Software interface

### Functions of SiteMonitor include:

- Easy to install: SiteMonitor is designed to operate under Windows, Linux, Solaris, AIX, HP-UX operating systems, and it provides multi-platform management.
- Automatic equipment search and configuration, saving the trouble of manual configuration.
- Current data query: Current equipment operating data and alarm data can be queried.
- Alarm notification: SiteMonitor can send email, short message to or phone the user in the event of an alarm.
- Remote control: This function is available only for equipment supporting remote control.
- Remote adjustment: This function is available only for equipment supporting remote adjustment.
- Real-time monitoring of environmental signals, such as temperature, humidity, smoke and fog, water logging, infrared, and power data, like 3-phase AC power, DC power.
- Convenient report query: SiteMonitor provides equipment alarm report, equipment data report and operation log report, and supports report display by page and data export functions.
- Powerful user management function: Users can be added, modified, deleted, and given different levels of software operation authorities according to their duties.
- Powerful online data backup and recovery: Providing quick system data backup and recovery without affecting other users.

### Note

- 1. The SiteMonitor also works with SHUTDOWN software to protect ongoing sessions on computer. For details, please refer to Network Shutdown Software (UNIX & Netware Version) User Manual and Network Shutdown Software (Windows Version) User Manual.
- 2. For detailed descriptions of SiteMonitor, refer to SiteMonitor Monitoring Software User Manual.

# **Appendix 2 Circuit Diagram of DME16**

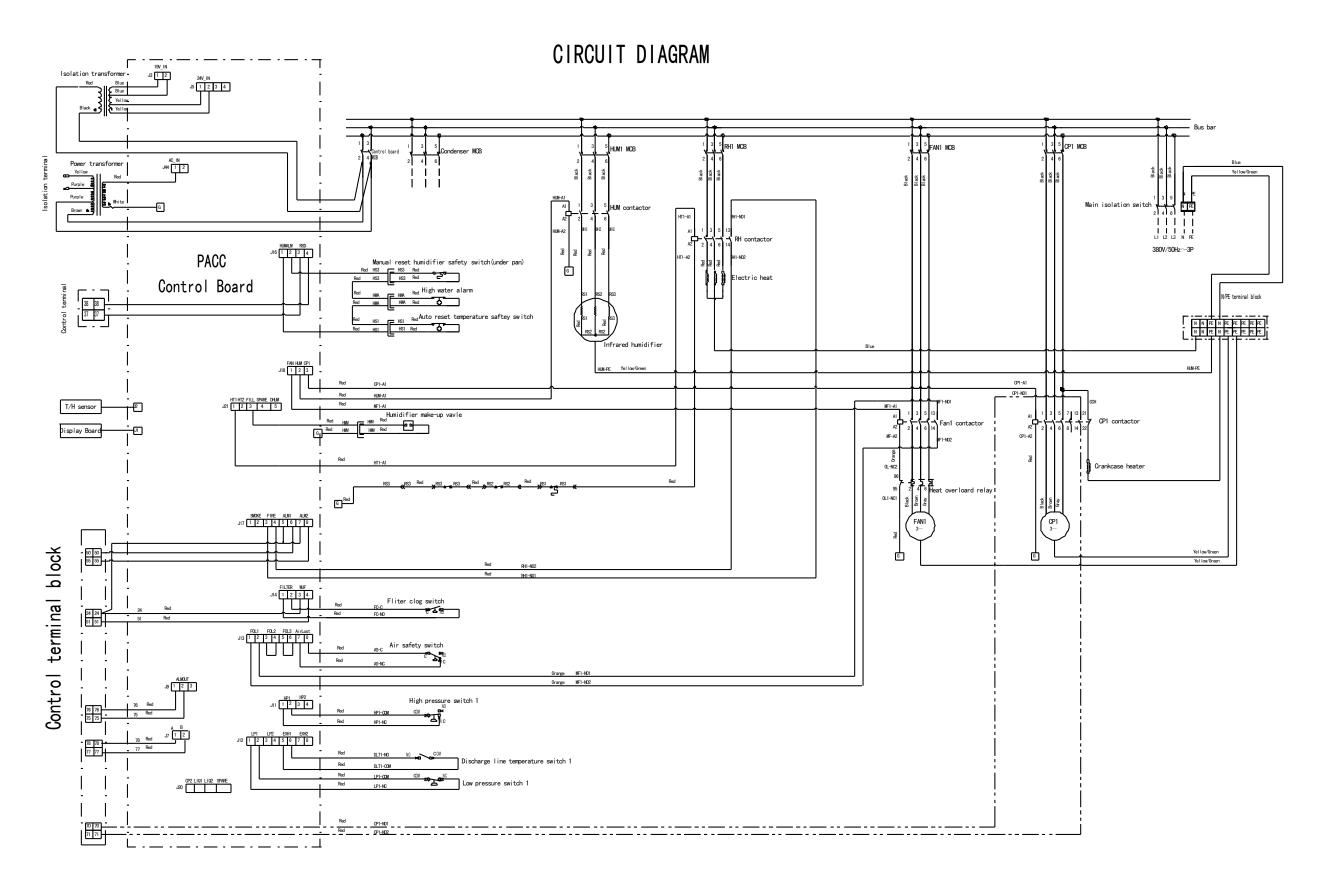


Figure 2 Circuit diagram of DME16

# Appendix 3 Circuit diagram of DMC16M2

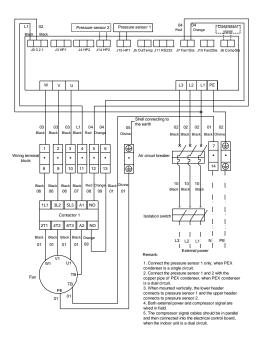


Figure 3 Circuit diagram of DMC16M2

# **Appendix 4 Menu Structure**

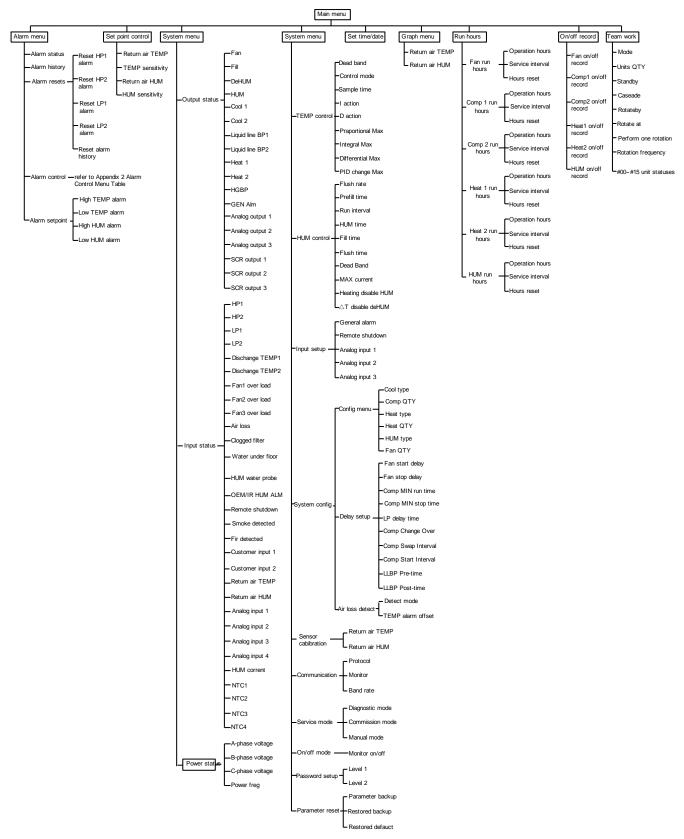


Figure 4 menu structure

# **Appendix 5 Alarm Control Menu Table**

		Alarm control		
High TEMP	Low TEMP	High HUM	Low HUM	Discharge TEMP1
Discharge TEMP2	Coil1 frost	Coil2 frost	Fan1 overload	Fan 2 overload
Fan3 overload	Short cycle1	Short cycle2	Air loss	Clogged filter
Remote shutdown	T/H board error	Unit #00	Unit #01	Unit #02
		disconnected	disconnected	disconnected
Unit #03	Unit #04	Unit #05	Unit #06	Unit #07
disconnected	disconnected	disconnected	disconnected	disconnected
Unit #08	Unit #09	Unit #10	Unit #11	Unit #12
disconnected	disconnected	disconnected	disconnected	disconnected
Unit #13	Unit #14	Unit #15	HP1 lock	HP2 lock
disconnected	disconnected	disconnected		
LP1 lock	LP2 lock	High TEMP	Low TEMP	High HUM
Low HUM	IR HUM error	OEM HUM error	HUM low water	Fan hours exceeded
C1 hours exceeded	C2 hours exceeded	Heat1 hours	Heat2 hours	HUM hours exceeded
		exceeded	exceeded	
Power loss	Power high	Powe low	Freq error	Phase loss
Phase reverse	Discharge TEMP1	Discharge TEMP2	Coil1 frost lock	Coil2 frost lock
	lock	lock		
Smoke detected	Fire detected	Customer input1	Customer input2	

Figure 5 Alarm Control Menu Table

# **Appendix 6 Parameter Setting Table**

Menu		Parameter	Default	Setting range
		Reset HP1 Alarm	No	Yes, No
		Reset HP2 Alarm	No	Yes, No
	Alarm resets	Reset LP1 Alarm	No	Yes, No
		Reset LP2 Alarm	No	Yes, No
		Reset Alarm History	No	Yes, No
		HP1	On	On, Event
		HP2	On	On, Event
		LP1	On	On, Event
		LP2	On	On, Event
		Discharge TEMP1	On	On, Event
		Discharge TEMP2	On	On, Event
		Discharge TEMP1 Lock	On	On, Event
		Discharge TEMP2 Lock	On	On, Event
		Coil1 Frost	On	On, Event
		Coil2 Frost	On	On, Event
		Fan1 Overload	On	On, Event
		Fan2 Overload	On	On, Event
		Fan3 Overload	On	On, Event
		Short Cycle1	On	On, Event
		Short Cycle2	On	On, Event
		Air Loss	On	On, Event
		Clogged Filter	On	On, Event
		Remote Shutdown	On	On, Event
	Alarm control	T/H Board Error	On	On, Event
Alarm menu		Unit #00 Disconnected	On	On, Event
		Unit #01 Disconnected	On	On, Event
		Unit #02 Disconnected	On	On, Event
		Unit #03 Disconnected	On	On, Event
		Unit #04 Disconnected	On	On, Event
		Unit #05 Disconnected	On	On, Event
		Unit #06 Disconnected	On	On, Event
		Unit #07 Disconnected	On	On, Event
		Unit #08 Disconnected	On	On, Event
		Unit #09 Disconnected	On	On, Event
		Unit #10 Disconnected	On	On, Event
		Unit #11 Disconnected	On	On, Event
		Unit #12 Disconnected	On	On, Event
		Unit #13 Disconnected	On	On, Event
		Unit #14 Disconnected	On	On, Event
		Unit #15 Disconnected	On	On, Event
		HP1 Lock	On	On, Event
		HP2 Lock	On	On, Event
		LP1 Lock	On	On, Event
		LP2 Lock	On	On, Event
		High TEMP	On	On, Event, Off
		Low TEMP	On	On, Event, Off
		High HUM	On	On, Event, Off
		Low HUM	On	On, Event, Off
		IR HUM Error	On	On, Event, Off

	Mani		D	moto:	Appendix 6 Parar	
Menu			meter	Default	Setting range	
		OEM HUM Error HUM Low Water		On	On, Event, Off	
					On	On, Event, Off
			Fan Hours Ex		On	On, Event, Off
			C1 Hours Exc		On	On, Event, Off
			C2 Hours Exc		On	On, Event, Off
		Heat1 Hours Exceeded Heat2 Hours Exceeded		On	On, Event, Off	
				On	On, Event, Off	
			HUM Hours E	xceeded	On	On, Event, Off
	Alarm	Control	Power Loss		On	On, Event, Off
Alarm Menu			Power High		On	On, Event, Off
			Power Low		On	On, Event, Off
, uaim mona			Freq Error		On	On, Event, Off
			Phase Loss		On	On, Event, Off
			Phase Revers	se	On	On, Event, Off
				Alarm Control	On	On, Event, Off
			Input	Normal Status	Open	Open, Closed
			High TEMP a	larm	35°C	30°C ~ 45°C
			Low TEMP al		15°C	5°C ~ 20°C
	Alarm	Alarm Setpoint			65%RH	65%RH ~ 90%RH
			High HUM ala		35%RH	10%RH ~ 35%RH
			Return Air TE		24°C	15°C ~ 35°C
			TEMP Sensiti		3°C	1°C ~ 10°C
Ş	Set Point Contro	l		•		
			Return Air HUM		50%RH	20%RH ~ 80%RH
	1	1	HUM Sensitiv Alarm Enable	•	5%RH	1%RH ~ 10%RH
					Enable	Enable, Disable
System Status		NTC 0, NTC 1, NTC 2,	High TEMP A		35°C	30°C ~ 45°C
Status		NTC 3			15°C	5°C ~ 20°C
			TEMP Calibra	ation	0°C	-10°C ~ 10°C
			DeadBand Control Mode		0°C	1°C ~ 5°C
					Proportion	Proportion, PID
					25s	1s ~ 300s
			I Action		90s	0 ~ 9000s
	TEMP	Control	D Action		5s	0 ~ 9000s
				MAX	100%	0 ~ 200%
			Integral MAX		100%	0 ~ 200%
			Differential M.	AX	100%	0 ~ 200%
			PID change MAX		20%	0 ~ 200%
			Flush Rate		150%	100% ~ 500%
			Prefill Time		30s	10s ~ 300s
			Run Interval		15h	5h ~ 25h
System					8/10min (IFM/IFL)	1min ~ 15min
Menu			Fill Time		4/7min (IFM/IFL)	1min ~ 15min
	HUM (	HUM Control			10s	5s ~ 30s
					0%RH	1%RH ~ 10%RH
					9A	6A, 9A, 12A
				ole HUM	Yes	Yes, No
					-3°C	-10°C ~-0.5°C
	<u> </u>		△T Disable DeHUM			
			Cool Type		Air	Air, Water, CW
			Comp QTY		2	0 ~ 2
	System	Config Menu	Heat Type		EH	EH
		Johns World	Heat QTY		1	1 ~ 2
	Config					
	Config		Fan QTY HUM Type		3 IRL	1 ~ 3 IRM, IRL, CAREL, CM+

Menu		Parameter	Default	Setting rable 7	
		Fan Start Delay	10s	10s ~ 300s	
			Fan Stop Delay	10s	10s ~ 300s
			Comp MIN Run Time	180s	60s ~ 600s
			Comp MIN Stop Time	180s	60s ~ 600s
			LP Dalay Time	180s	30s ~ 600s
	C: rata ra	Delay Setup	Comp Change Over	No	Yes, No
	System				· ·
	Config		Comp Swap Interval	100h	100h ~ 1000h
			Comp Start Interval	3s	1s ~ 30s
			LLBP Pre-time	0s	0s ~ 30s
			LLBP Post-time	0s	0s ~ 30s
Sytem Menu		Air Loss	Detect Mode	△T	∆T, ∆P
,		Detect	TEMP Alarm Offset	15°C	10°C ~ 30°C
			Protocol	YDN23	YDN23
	Commi	ınication	Monitor ID	001	001 ~ 244
	Commi	incation	Baud Rate	9600bps	1200, 2400, 4800, 9600,
			Daud Nate	90000ps	19200bps
	On/off	f Mode	Monitor On/Off	Enable	Enable, Disable
	Deserve	and Control	Level 1	0000	0000 ~ 9999
	Passwo	rd Setup	Level 2	0001	0000 ~ 9999
			Parameter Backup	No	Yes, No
	Parameter Reset		Restored Backup	No	Yes, No
			Restored Default	No	Yes, No
			Service interval	30000h	0 ~ 30000h
	Fan Ru	n Hours	Hours reset	No	Yes, No
			Service interval	30000h	0 ~ 30000h
	Comp1 R	Run Hours	Hours reset	No	Yes, No
			Service interval	30000h	0 ~ 30000h
	Comp2 R	Run Hours	Hours reset	No	Yes, No
Run hours			Service interval	30000h	0 ~ 30000h
	Heat1 R	un Hours	Hours reset	No	Yes, No
			Service interval	30000h	0 ~ 30000h
	Heat2 R	un Hours	Hours reset	No	Yes, No
			Service interval	30000h	0 ~ 30000h
	HUM Ru	ın Hours	Hours reset	No	Yes, No
			Mode	Single	Single, 0, 1, 2, 3
				0	1 ~ 16
			Unit QTY		
			Standby	0	0 ~ 15
		Cascade	No	Yes, No	
	Team Work		Rotate By	0	1 ~ 8
. 54		Rotate At	12	0 ~ 23	
			Perform One Rotation	No	Yes, No
			Rotate Frequency	NONE	NONE, EVERY, MON, TUE, WED, THU, FRI, SAT, SUN

### **Emerson Network Power Asia**

 Australia
 Pakistan

 T: 1800-065345
 T: 92-42-36622526 to 28

 F: 61-2-97810252
 F: 92-42-36622530

 Indonesia
 Philippines

 T: 62-21-2513003
 T: 63-2-7207400

 F: 62-21-2510622
 F: 63-2-6203693

 Japan
 Singapore

 T: 81-3-54038564
 T: 65-64672211

 F: 81-3-54032919
 F: 65-64670130

F: 81-3-54032919 F: 65-64670130 **Korea** Thailand

T: 82-2-34831500 T: 66-2-6178260 F: 82-2-5927886 F: 66-2-6178277 to 78

 Malaysia
 Vietnam

 T: 603-78845000
 T: 84-4-37628908

 F: 603-78845188
 F: 84-4-37628909

**New Zealand** T: 64-3-3392060 F: 64-3-3392063

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